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(*Recognosce notum, ignotum inspice*)

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CARLETON REA and J. RAMSBOTTOM

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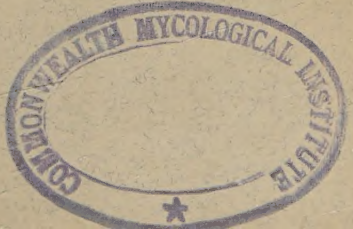

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The President and Secretary of the Society *ex Officio*.

The Transactions for 1919 *will be published in two parts.*

THE BASLOW FORAY.

22nd–27th September, 1919.

The twenty-third annual week's Fungus Foray was held at Baslow, Derbyshire, from September 22nd to September 27th, 1919. This first post-war meeting was attended by some thirty-two members and visitors, and was in every way a most enjoyable one. Unfortunately however, not only in Derbyshire but generally, the autumn of 1919 was a bad season for fungi, consequently the list of species numbers only three hundred and ninety-one, as compared with the 1909 list of five hundred and thirty-three. The difference is the more marked when it is remembered that the number, three hundred and ninety-one, was only attained after practically a fortnight's work on the part of various members of the party. A few enthusiasts had spent the previous week-end at Baslow, and owing to the railway strike a number of members were held up for some days after the 27th, spending their time in adding as far as possible to the records for the Foray.

The headquarters for the meeting were at the Grand Hotel and Hydro, where the manager kindly placed at our disposal a large room for the exhibition of specimens and the holding of meetings.

Here on the Monday evening various fungi of interest brought by members were placed on exhibition. Dr Adams* had brought from Keswick *Tricholoma imbricatum*, *Lactarius mitissimus*, *Cortinarius pholideus*, and *Boletus porphyrosporus*, and from Looe *Polyporus varius*. Mr Rea showed *Marasmius foetidus*, *Leptonia euchlora*, *Cortinarius caerulescens*, and *Lycoperdon velatum*, all from Tick Wood, Shropshire. Subsequently Mr N. G. Hadden sent from West Porlock *Boletus sulphureus* and *Paxillus panuoides*, both found growing on sawdust.

On Tuesday, September 23rd, the party started out through the Yeld Wood at the back of the Hotel, intending to make for some promising ground near a stream which had been noticed the previous day. Unfortunately however the way was missed, and instead we found ourselves on a high moorland, which yielded nothing but numerous specimens of *Anellaria separata*, growing on cow-dung. It was decided to attempt a short cut back to Baslow by climbing down, a proceeding which was

* Members will learn with deep regret that Dr Adams has since passed away. The Society is glad to welcome his son, Mr J. Adams, who was also present at Baslow, as a member.

found somewhat difficult, especially for the ladies, owing to the very rough nature of the ground. During this return journey the party became broken up, and various members succeeded in finding more suitable collecting ground in copses round the village, with the result that quite a fair number of species had been gathered by lunch-time. After lunch at the Hotel, a few members went out again, chiefly into the Yeld Wood, but others stayed in in order to sort and work out the specimens already collected. A piece of old sacking yielded *Botryotrichum piluliferum**, new to Britain, subsequently reported by Miss Lorrain Smith.

In the evening, the Annual General Meeting was held, the President, Dr Wager, occupying the chair. The Officers and Council for 1920 were elected (see p. 2 of cover) and the new Rules, with some slight amendments, chiefly verbal, were confirmed. Mr A. D. Cotton urged the necessity of the Society taking a more active part in the development of Plant Pathology in Great Britain, and suggested the formation of a special sub-committee to deal with questions of interest to plant pathologists. After a vigorous discussion the general opinion seemed to be that some steps should be taken to make it clear that the Society includes in its scope *all* branches of mycology, including pathology, but the details of action were left to be settled by the Council†.

After the adoption of the balance sheet for the year, the Treasurer pointed out that it may become necessary to raise the subscription in 1920, to meet the enormously increased cost of printing. Should this become necessary, due notice will be given before the next Annual General Meeting. It was resolved to publish the Transactions for the future in two half yearly parts.

Miss Lorrain Smith then showed a very interesting abnormal specimen of *Fomes ulmarius*, which had been found in a drain 30 feet below the surface of the ground.

On the following day, Sept. 24th, motors were in attendance at 10.0 a.m., and the party was taken first to Highlow Wood. This being a damp wood with much fallen timber lying about was specially productive of resupinate Hymenomycetes. Miss Wakefield collected the new species *Hypochnus roseo-griseus*, which was described for the first time last year. The Rev. C. Fynes-Clinton gathered a fine specimen of *Fomes conchatus*, and Mr Thos. Smith brought in *Dacryomitra glossoides*, which was also gathered at the 1909 Foray. Messrs Pearson and Rea

* For description see New or Rare Microfungi, to be published later.

† At a Council Meeting held December 17th, 1919, a sub-committee for plant pathology was constituted as follows: F. T. Brooks, M.A. (*Chairman*), A. D. Cotton, F.L.S. (*Secretary*), G. H. Pethybridge, B.Sc., Ph.D., J. Ramsbottom, M.A., F L.S., together with the President and Secretary of the Society *ex officio*.

secured *Mycena dilatata*, new to the British flora, and *M. chlorantha*. The party then motored back as far as Padley Wood, where a halt was made for lunch. Here a few interesting species were obtained, notably *Naucoria Cucumis*, and *Galactinia Phillipsii*, the latter discovered by Miss Noel. It is a beautiful Discomycete, remarkable for the large sculptured violet spores. Owing to the description of the spores as hyaline in Massee's "Fungus Flora," vol. IV, there was some discussion as to whether the colour had not diffused into the epispore from other parts of the fructification. The specimens examined however left no doubt that the spores are at first hyaline, but when mature are covered by a violet-coloured warted epispore. This confirms Phillips' original description as set out in *Grevillea*, IV. 84, for *Ascobolus amethystinus**.

Stoke Wood was then visited, and here the first fungus to be found was a large and beautiful group of *Clitocybe connata*, growing close to the gate. This wood proved to be poorest in species of the three visited, and the only other find of special interest was *Nolanea araneosa*, also recorded in 1909.

In the evening, at 9 o'clock, Dr Wager delivered his Presidential address, entitled "The Sexuality of the Fungi."

On Thursday, Sept. 25th, the party was conducted over the grounds of Chatsworth by the head forester, Mr J. P. Robertson. As was natural the greater number of the Agarics collected on this day were species characteristic of pastures. *Hygrophorus clivalis, Reai*, and *russo-coriaceus* were all noted by Mr Rea. It was particularly interesting to find *H. Reai* because it was first described from this locality at the Baslow Foray of 1909. *Merulius lacrymans* var. *minor* was found by Dr Bayliss Elliott, while some other noteworthy species observed were *Hypholoma pyrotrichum, Inocybe fastigiata, I. destricta* and *Corticium botryosum* growing on dead stems of *Pteris aquilina*.

At the evening meeting Mr. A. A. Pearson, F.L.S., read a paper on "Cystidia as a Generic Character" and Mr W. B. Brierley gave an account of "Mutations among Fungi," which evoked a good deal of discussion.

On Friday, Sept. 26th, in a heavy downpour of rain, Calton Lees wood-yard was first visited, but yielded only a few fungi. Mr Robertson then conducted the party to New Piece Wood, where *Lactarius fuliginosus* and *L. theiogalus* were perhaps the most interesting finds. After lunch at the Hotel some members paid a visit to Haddon Hall, the historical and romantic interest of which eclipsed mycology, for the only record brought in was *Puccinia Malvacearum*!

* There seems to have been some confusion as to the nomenclature of this species. It is hoped to publish a note on it in the next part.

In the evening the formal meeting was brought to a close by hearty votes of thanks to the owners and factors who had given permission for their woods to be visited, to Dr Wager for presiding, and to the Treasurer and Secretary for the general management of the meeting.

For assistance in compiling the subjoined list of species the Secretary is much indebted to Mr Carleton Rea, Miss A. Lorrain Smith, Dr Bayliss Elliott, Mr A. D. Cotton and Mr C. H. Grinling.

COMPLETE LIST OF FUNGI GATHERED DURING THE FORAY.

C. = Chatsworth; *H.* = Highlow Wood; *P.* = Padley Wood; *S.* = Stoke Wood; *N.* = New Piece Wood, Chatsworth; *B.* = neighbourhood of Burbage Brook. Where not otherwise indicated the locality is the immediate neighbourhood of Baslow.

Amanita muscaria (Linn.) Fr., *H.*, *P.*, rubescens (Pers.) Fr., pantherina (DC.) Fr., *C.*

Amanitopsis vaginata (Bull.) Roze, *H.*, strangulata (Fr.) Roze.

Lepiota procera (Scop.) Fr., *C.*, rachodes (Vitt.) Fr., cristata (A. & S.) Fr., amianthina (Scop.) Fr., *H.*

Armillaria mellea (Vahl.) Fr.

Tricholoma rutilans (Schaeff.) Fr., *C.*, imbricatum Fr., terreum (Schaeff.) Fr., *C.*, argyraceum (Bull.) Fr., cuneifolium Fr., *H.*, carneum (Bull.) Fr., *C.*, album (Schaeff.) Fr., personatum (Fr.) Berk., *C.*, cinerascens (Bull.) Quél. (Syn. Clitocybe fumosa Fr.), melaleucum (Pers.) Fr., var. phaeopodium (Bull.) Quél.

Clitocybe clavipes (Pers.) Fr., rivulosa (Pers.) Fr., phyllophila Fr., candicans (Pers.) Fr., *H.*, dealbata (Sow.) Fr., var. minor Cooke, *C.*, connata (Schum.) Fr., *S.*, infundibuliformis (Schaeff.) Fr., *C.*, brumalis Fr., *Bolehill Wood*, metachroa (Fr.) Berk., *C.*, ditopus Fr., *H.*

Laccaria laccata (Scop.) Berk. & Br.

Collybia radicata (Rehl.) Berk., *S.*, platyphylla Fr., *S.*, fusipes (Bull.) Berk., maculata (A. & S.) Fr., *H.*, *C.*, butyracea (Bull.) Fr., vertirugis Cooke, *B.*, confluens (Pers.) Fr., *C.*, tuberosa (Bull.) Fr., *P.*, xanthopus Fr., acervata Fr., *P.*, dryophila (Bull.) Fr., ambusta Fr., *B.*, clusilis Fr., *Monsal Dale.*

Mycena olivaceo-marginata Mass., *C.*, pura (Pers.) Fr., *S.*, chlorantha Fr., *H.*, lactea (Pers.) Fr., *H.*, galericulata (Scop.)

Fr., polygramma (Bull.) Fr., ammoniaca Fr., metata Fr., *C.*, amicta Fr., *C.*, Iris Berk., *B.*, vitilis Fr., *B.*, sanguinolenta (A. & S.) Fr., galopus (Pers.) Fr., var. alba Fl. Dan., var. nigra Fl. Dan. (Syn. M. leucogala Cooke), *H.*, *P.*, epipterygia (Scop.) Fr., *P.*, rorida Fr., *P.*, pelliculosa Fr., *P.*, dilatata Fr.*, *H.*, tenerrima Berk., corticola (Schum.) Fr.

Omphalia umbellifera (Linn.) Fr., *P.*, velutina Quél., *C.*, fibula (Bull.) Fr., var. Swartzii Fr.

Pleurotus ulmarius (Bull.) Fr., *Great Longstone.*

Hygrophorus pratensis (Pers.) Fr., virgineus (Wulf.) Fr., *C.*, niveus (Scop.) Fr., russo-coriaceus Berk & Br., *C.*, clivalis Fr., *C.*, ovinus (Bull.) Fr., laetus (Pers.) Fr., *B.*, ceraceus (Wulf.) Fr., *C.*, coccineus (Schaeff.) Fr., *C.*, *B.*, miniatus Fr., *P.*, conicus (Scop.) Fr., Reai Maire, *C.*, psittacinus (Schaeff.) Fr., *B.*

Lactarius pubescens Fr., turpis (Weinm.) Fr., *B.*, blennius Fr., *C.*, quietus Fr., theiogalus Fr., *N.*, rufus (Scop.) Fr., glyciosmus Fr., fuliginosus Fr., *N.*, serifluus (DC.) Fr., *C.*, mitissimus Fr., subdulcis (Pers.) Fr., *H.*

Russula nigricans (Bull.) Fr., *S.*, *N.*, adusta (Pers.) Fr., furcata (Pers.) Fr., virescens (Schaeff.) Fr., *C.*, atropurpurea (Krombh.) Maire, vesca Fr., cyanoxantha (Schaeff.) Fr., *S.*, *N.*, foetens (Pers.) Fr., *C.*, fellea Fr., *N.*, emetica (Schaeff.) Fr., ochroleuca (Pers.) Fr., *B.*, *H.*, *N.*, fragilis (Pers.) Fr., *P.*, lutea (Huds.) Fr., *B.*

Cantharellus cibarius Fr., *C.*, aurantiacus (Wulf.) Fr.

Nyctalis parasitica (Bull.) Fr., *C.*

Marasmius peronatus (Bolt.) Fr., oreades (Bolt.) Fr., *C.*, ramealis (Bull.) Fr., rotula (Scop.) Fr., androsaceus (Linn.) Fr.

Lentinus cochleatus (Pers.) Fr., *H.*

Panus stypticus (Bull.) Fr., *C.*

Lenzites betulina (Linn.) Fr., *C.*

Pluteus cervinus (Schaeff.) Fr., nanus (Pers.) Fr., *S.*

Entoloma prunuloides Fr., *C.*, rhodopolium Fr., costatum Fr., sericeum (Bull.) Fr.

Leptonia lampropus Fr., *P.*, *C.*, sericella (Fr.) Quél., *S.*

Nolanea pascua (Pers.) Fr., *B.*, proletaria Fr., papillata Bres., araneosa Quél., *S.*

Eccilia griseo-rubella (Lasch.) Fr., *C.*

Claudopus variabilis (Pers.) W.G.Sm., *P.*

Pholiota erebia Fr., *S.*, togularis (Bull.) Fr., subsquarrosa Fr., *N.*, spectabilis Fr., mutabilis (Schaeff.) Fr., *Bolehill Wood*, marginata (Batsch) Fr.

* New to Britain. For description see New or Rare British Fungi to be published later.

Bolbitius titubans (Bull.) Fr., *C.*

Inocybe cincinnata Fr., *C.*, incarnata Bres., *B.*, *C.*, obscura (Pers.) Fr., *B.*, fastigiata (Schaeff.) Fr., *C.*, rimosa (Bull.) Fr., *B.*, *C.*, asterospora Quél., *B.*, *N.*, proximella Karst., *N.*, eutheles Berk & Br., *B.*, destricta Fr., *C.*, geophylla Fr.

Hebeloma fastibile Fr., glutinosum (Lindg.) Fr., *N.*, mesophaeum Fr., crustuliniforme (Bull.) Fr.

Flammula sapinea Fr., *H.*, *N.*, flavida (Schaeff.) Fr.

Naucoria Cucumis (Pers.) Fr., *P.*, melinoides Fr., *C.*, semiorbicularis (Bull.) Fr., *Froggatt Edge*, sobria Fr., *Bolehill Wood*, escharoides Fr.

Galera tenera (Schaeff.) Fr., hypnorum (Schrank) Fr., mycenopsis Fr., *C.*

Tubaria furfuracea (Pers.) W.G.Sm., paludosa Fr., *C.*, inquilina Fr., *Bolehill Wood.*

Cortinarius (Myxacium) elatior (Pers.) Fr., *P.*, *N.*

— (Dermocybe) tabularis (Bull.) Fr., *H.*, *N.*, caninus Fr.

— (Telamonia) torvus Fr., *P.*, hinnuleus (Sow.) Fr., *P.*, iliopodius Fr., *Bolehill Wood*, hemitrichus (Pers.) Fr., *Bolehill Wood*, rigidus (Scop.) Fr.

— (Hydrocybe) castaneus (Bull.) Fr., leucopus (Bull.) Fr., *C.*, decipiens (Pers.) Fr., *Bolehill Wood*, acutus (Pers.) Fr., *C.*

Paxillus involutus (Batsch) Fr., panuoides Fr., *C.*

Psaliota xanthoderma (Genev.) W.G.Sm., campestris (Linn.) Fr., *C.*, comtula Fr., *H.*

Stropharia aeruginosa (Curt.) Fr., *C.*, albocyanea (Desm.) Fr., inuncta Fr., *C.*, squamosa (Pers.) Fr., *C.*, merdaria Fr., *Froggatt Edge*, semiglobata (Batsch) Fr.

Hypholoma capnoides Fr., *N.*, epixanthum Fr., *P.*, fasciculare (Huds.) Fr., pyrotrichum (Holmsk.) Fr., *C.*, velutinum (Pers.) Fr., *S.*, leucotephrum Berk. & Br.

Psilocybe sarcocephala Fr., *Monsal Dale*, uda (Pers.) Fr., *C.*, semilanceata Fr., *C.*, foenisecii (Pers.) Fr.

Psathyra corrugis (Pers.) Fr., *C.*, fibrillosa (Pers.) Fr., conopilea Fr., *Froggatt Edge.*

Coprinus comatus (Fl. Dan.) Fr., atramentarius (Bull.) Fr., cinereus (Schaeff.) Fr., niveus (Pers.) Fr., micaceus (Bull.) Fr., plicatilis (Curt.) Fr., *S.*, *C.*, ephemerus (Bull.) Fr., *C.*

Panaeolus sphinctrinus Fr., campanulatus (Linn.) Fr., *C.*, papilionaceus (Bull.) Fr., *C.*

Anellaria separata (Linn.) Karst.

Psathyrella gracilis (Pers.) Fr., atomata Fr., *N.*, crenata (Lasch) Fr., *Bolehill Wood*, disseminata (Pers.) Fr., *S.*, *C.*

Boletus elegans (Schum.) Fr., *B.*, granulatus (Linn.) Fr., *C.*, badius Fr., *B.*, piperatus (Bull.) Fr., *C.*, chrysenteron (Bull.) Fr., subtomentosus (Linn.) Fr., *B.*, edulis (Bull.)

Fr., *B.*, *C.*, luridus (Schaeff.) Fr., *C.*, versipellis Fr., *Bolehill Wood*, scaber (Bull.) Fr., *P.*

Fistulina hepatica (Huds.) Fr., *C.*

Polyporus squamosus (Huds.) Fr., *C.*, and f. erecta Bres., *Calton Lees*, nummularius (Fr.) Quél., sulphureus (Bull.) Fr., *C.*, dryadeus (Pers.) Fr., *C.*, betulinus (Bull.) Fr., adustus (Willd.) Fr., *S.*, lacteus Fr., fragilis Fr., *H.*

Fomes connatus Fr., *H.*, annosus Fr., conchatus (Pers.) Karst., *H.*, ferruginosus (Fr.) Mass.

Polystictus versicolor (Linn.) Fr.

Poria mollusca (Pers.) Fr., *S.*, hymenocystis Berk. & Br., *H.*, sanguinolenta (A. & S.) Fr., *H.*

Merulius lacrymans (Wulf.) Fr., var. minor Falck, *C.*

Hydnum repandum (Linn.) Fr., *C.*, rufescens (Pers.) Fr., *C.*

Caldesiella crinalis (Fr.) Bourd. & Galz.

Irpex obliquus (Schrad.) Fr.

Phlebia merismoides Fr., *S.*

Odontia alutacea (Fr.) Quél., fimbriata (Pers.) Fr., farinacea (Pers.) Quél.

Grandinia granulosa Fr.

Stereum hirsutum (Willd.) Fr., purpureum (Pers.) Fr., spadiceum (Pers.) Fr., *C.*, sanguinolentum (A. & S.) Fr., rugosum (Pers.) Fr., *H.*

Corticium Sambuci (Pers.) Fr., *S.*, botryosum Bres., *C.*, subcoronatum von Hoehn. & Litsch., *B.*, confluens Fr., *H.*, confine Bourd. & Galz., *H.*, *S.*, *N.*, sulphureum (Pers.) Bres., *H.*, praetermissum (Karst.) Bres., *B.*, *H.*, porosum Berk. & Br., albo-stramineum (Bres.) Wakef., *H.*, *N.*

Peniophora pallidula Bres., *B.*, cremea Bres., *N.*, velutina (DC.) Cooke, *H.*, setigera (Fr.) Bres., *S.*, pubera (Fr.) Mass., *H.*, gigantea (Fr.) Mass., *N.*, aurantiaca Bres., *H.*, incarnata (Pers.) Cooke, *H.*, maculaeformis (Fr.) Bourd. & Galz., *B.*, cinerea (Fr.) Cooke, quercina (Pers.) Cooke, hydnoides Cooke & Mass., *H.*

Hypochnus zygodesmoides (Ell.) Burt, *N.*, roseo-griseus Wakef. & Pears., *H.*

Coniophora arida Fr., *B.*

Cyphella capula (Holmsk.) Fr.

Solenia anomala (Pers.) Fr., *C.*

Clavaria cristata (Holmsk.) Fr., cinerea (Bull.) Fr., corniculata (Schaeff.) Fr., *C.*, and var. pratensis (Fr.) Cotton & Wakef., fusiformis (Sow.) Fr., *C.*, acuta (Sow.) Fr., rugosa (Bull.) Fr., inaequalis (Müll.) Fr.

Pistillaria quisquiliaris Fr., *C.*

Tremella mesenterica (Retz.) Fr., *S.*

Dacryomyces deliquescens (Bull.) Duby, *S.*, *N.*

Calocera viscosa (Pers.) Fr., cornea (Batsch) Fr.
Dacryomitra glossoides (Pers.) Bref., *H.*
Phallus impudicus (Linn.) Pers., *H.*
Mutinus caninus (Huds.) Fr., *H.*
Sphaerobolus stellatus (Tode) Pers.
Crucibulum vulgare Tul.
Bovista plumbea Pers.
Lycoperdon depressum Bon., pyriforme (Schaeff.) Fr., *C.*, umbrinum Pers., *P.*, *C.*, perlatum Pers., *P.*
Scleroderma vulgare Hornem.
Puccinia Lychnidearum Link, *C.*, Malvacearum Mont., *Haddon Hall*, pulverulenta Grev., on *Epilobium hirsutum, Miller's Dale*, Valantiae Pers., on *Galium cruciatum, Miller's Dale*, obtegens (Link.) Tul., *C.*, Hieracii (Schum.) Mart., *C.*, Lampsanae (Schultz) Fuck., *C.*, Leontodontis Jacky, *Miller's Dale*, Menthae Pers., *N.*, obscura Schroet., *C.*, triticina Eriks., Poarum Niels. (Aecidium on *Tussilago*).
Phragmidium Sanguisorbae (DC.) Schroet., *Stoney Middleton.*
Coleosporium Tussilaginis (Pers.) Kleb., *C.*, Sonchi-arvensis (Pers.) Lév., on *Sonchus arvensis, Miller's Dale.*
Ustilago violacea (Pers.) Wint., on *Lychnis dioica.*
Frankiella Alni (Wor.) Maire, near saw-mill, Baslow.
Erysiphe communis (Wallr.) Fr., graminis (DC.) Fr.
Nectria cinnabarina (Tode) Fr.
Hypocrea rufa (Pers.) Fr., *Bolehill Wood.*
Hypomyces torminosus on *Lactarius pubescens.*
Cordyceps militaris (Linn.) Link, with the conidial stage also.
Xylaria polymorpha (Pers.) Grev., Hypoxylon (Linn.) Grev., *S.*, *N.*
Rhopographus Pteridis (Sow.) Wint., *C.*
Helvella crispa (Scop.) Fr., *S.*
Rhizina inflata (Schaeff.) Karst., *B.*
Aleuria micropus (Pers.) Gill., *H.* (*fide* Dr Bayliss Elliott).
Galactinia Phillipsii (Cooke) Boud., *P.*
Otidea cochleata (Linn.) Fuck., *S.*
Peziza aurantia Pers., *C.*
Ciliaria scutellata (Linn.) Quél., *S.*
Coprobia granulata (Bull.) Boud.
Ascobolus Crouani Boud., *C.*, stercorarius (Bull.) Schroet.
Leotia lubrica (Scop.) Pers., *N.*
Cudoniella acicularis (Bull.) Schroet.
Coryne sarcoides (Jacq.) Tul.
Bulgaria inquinans (Pers.) Fr.
Corynella glabro-virens Boud., *B.*
Orbilia xanthostigma Fr.
Ciboria Sydowiana Rehm.

Sclerotinia Curreyana (Berk.) Karst., *N.*
Phialea firma (Pers.) Gill.
Chlorosplenium aeruginosum (Oeder.) de Not., *S.*
Helotium fructigenum (Bull.) Fuck., cyathoideum (Bull.) Karst., *C.*, scutula (Pers.) Karst., virgultorum (Wahl.) Karst.
Dasyscypha Soppittii Mass., *C.*
Trichoscypha calycina (Schum.) Boud., *H.*
Hyaloscypha hyalina (Pers.) Boud., *C.*
Urceolella puberula (Lasch) Boud.
Mollisia cinerea (Batsch) Karst., benesuada (Tul.) Phill.
Stegia Ilicis Fr., *C.*
Rhytisma acerinum (Pers.) Fr.
Empusa muscae Cohn, *N.*
Phytophthora infestans (Mont.) de Bary, *C.*
Peronospora parasitica (Pers.) Tul., *C.*
Cystopus cubicus (Strauss) de Bary, *Monsal Dale*, candidus (Pers.) de Bary, on *Arabis.*
Spinellus fusiger (Link) van Tiegh., *C.*
Pilobolus crystallinus (Wiggers) Tode.
Phoma complanata (Tode) Desm., on *Heracleum.*
Cytospora Laurocerasi Fuck.
Septoria graminum Desm.
Leptothyrium acerinum (Kze) Corda on *Acer campestre*, medium Cooke.
Oidium alphitoides Griff. & Maubl., *C.*
Cylindrium flavo-virens (Dittm.) Bon.
Trichoderma viride (Pers.) Fr.
Sporotrichum chrysospermum Harz., *C.*
Sepedonium chrysospermum (Bull.) Fr., *N.*
Ramularia calcea (Desm.) Ces.
Echinobotryum atrum Corda, *H.*
Botryotrichum piluliferum Sacc. & March.* on old sacking, *Baslow.*
Gonytrichum caesium Nees, *C.*
Cladosporium epiphyllum Mart., fulvum Cooke, on Tomato, *Baslow Hydro.*
Stysanus stemonites Corda, *H.*
Volutella nivea (Fr.) Sacc.
Epicoccum purpurascens Ehrenb., *N.*

* New to Britain. For description see New or Rare Microfungi to be published later.

MYCETOZOA FOUND DURING THE BASLOW FORAY.

By Gulielma Lister, F.L.S.

The visit of the British Mycological Society to Baslow had been arranged to take place from Monday, Sept. 22nd, to the following Saturday. Several of our party however arrived a few days earlier than the appointed time; and, owing to the railway strike, many were unable to leave at the end of the week; thus by the enforced extension of their visit a fuller opportunity was afforded for exploring the woods than had been anticipated. The weather for the previous weeks had been drier than the hunters for Mycetozoa could have wished, but on the whole a fair harvest of species was obtained.

On September 19th W. N. Cheesman searched some woods between Grindleford and Baslow, and found six species, including a good development of *Trichia verrucosa*. This species although it had been recorded from seven English counties, as well as from Wales and Scotland, is by no means common in the British Isles, and is a new record for Derbyshire. Mr Cheesman also obtained a fine gathering of *Cribraria rufa*.

On September 23rd the woods near Baslow were searched. These consisted of oak, ash, sycamore, poplar and beech, with some larch and Scots fir. Nineteen species were obtained. On fallen pine boughs *Didymium melanospermum* was abundant, and on the dead beech leaves amongst which the boughs were lying were found *Craterium minutum*, *Didymium nigripes* and *Lamproderma scintillans*. A large growth of *Craterium leucocephalum* occurred on dead oak leaves, and several gatherings of *Tubifera ferruginosa* were obtained in the rosy immature stage on old stumps.

On September 24th the party was conveyed by motor cars to explore three woods in the neighbourhood of Grindleford. In Highlow Wood the trees consisted of alder, birch, poplar, sycamore, larch and a little Scots fir; the moist peaty ground beneath was trenched with old draining ditches and rough with tussocks of *Aira caespitosa*. Thirteen species of Mycetozoa were found here, of which the most noteworthy were *Enteridium olivaceum*, forming small aethalia on dead sticks, a compact hemispherical aethalium of *Reticularia Lycoperdon* without any

enveloping cortex and showing distinctly the outlines of the component sporangia, and *Perichaena corticalis* abundant on the under surface of dead birch boughs lying among wet grass.

In Padley Wood, our lunching place, oaks clothed the steep sides of a ravine down which a stream fell in small cascades between fern-clad banks. Four species of Mycetozoa were found here, all on fallen boughs of oak: they were, *Comatricha nigra*, a minute form, *Arcyria nutans*, *A. pomiformis* and *Licea pusilla*; the sporangia of the last named species were, as usual, small and inconspicuous, matching in colour the dark decorticated wood on which they had developed. The spores proved to be unusually small, measuring 12 to 16μ, instead of 16 to 20μ, but were typical in colour and marking, being olive grey and very minutely warted all over. Stoke Wood formed a narrow strip beside the river Derwent, and consisted of sycamore and poplar with an undergrowth of dog's mercury, elder and rhododendrons. Of the three species found here the most striking was *Comatricha nigra* var. *alta* which formed conspicuous reddish brown patches extending over an area of six by twenty-four inches on the side of an old fencing plank: most of the sporangia were cylindrical on long slender stalks, but among them were globose sporangia with shorter stalks; the capillitium in all consisted of a tangle of sparingly branched flexuose threads attached chiefly to the base of the columella.

On September 25th we visited the timber yard and explored the woods and gardens of Chatsworth. Seventeen species were obtained, of which ten were found in the timber yard. Here *Fuligo septica* was very abundant on old pine trunks, and also *Arcyria nutans*. *Physarum psittacinum* and *Stemonitis ferruginea* were also found on these logs, in good condition; both are new records for Derbyshire. The fine old oaks, survivors of the giants of Sherwood Forest, scattered over grassy and bracken-covered slopes, yielded two interesting Mycetozoa, viz. *Cribraria rufa*, a species rarely found on any but coniferous wood, and a form of *Liceopsis lobata* having some sporangia stalked, globose and free, and others sessile and closely clustered.

Rough slopes of peaty soil above the Chatsworth gardens, clothed with cushion-like growths of the moss *Campylopus pyriformis*, recalled similar habitats in Epping Forest where *Colloderma oculatum* had repeatedly been obtained. No trace of this species was found at the time, but lumps of the mossy soil were brought away and kept moist; after a fortnight a sporangium of *Colloderma* made its appearance and was soon followed by others until after two months over thirty sporangia had developed.

A visit to the sawpits in the Chatsworth grounds on October 26th resulted in several additions to our list, among them being *Lindbladia effusa* found on sawdust, a species rare in England but obtained in the same locality during the visit of our society to Baslow in May, 1915.

On September 27th the woods called "New Piece" in the Chatsworth grounds were explored, when the most interesting finds were *Hemitrichia clavata*, and the conspicuous red sporangia of *Arcyria Oerstedtii*.

Two of our members visited later Calton Wood, on the Bakewell Road. Here, amongst other species, a small *Comatricha* was obtained on dead wood, agreeing on the whole with *C. elegans* in having the columella divided above to form the primary branches of the capillitium. Some of the sporangia however resemble *C. nigra* in having the columella unbranched and tapering upwards. The two species are undoubtedly very closely allied. Another interesting specimen was obtained by Mr Rea in Cheedale. He found there on a plant of *Mimulus Langsdorfii* growing in the river Wye a perfect development of *Physarum didermoides* var. *lividum*; this well-marked variety had only been recorded before with certainty from the counties of Bedfordshire, Buckinghamshire and Sussex, and always on old straw. In the present gathering we have a new record for Derbyshire and a new habitat for the species. As the plant to which the sporangia were attached was completely surrounded by running water we must infer that the plasmodium had been living under water before it crept up the Mimulus stalk to fruit. It is well known that a plasmodium can in special cases become adapted to submerged conditions, and may even thrive there, but such instances have rarely been met with in the field.

During the two previous forays at Baslow in September 1901 and May 1915, forty-four species of Mycetozoa were obtained altogether; during our recent foray forty-five species were collected, fifteen of which do not appear in the previous lists and appear to be new records for Derbyshire; they are distinguished by an asterisk in the following list.

B. refers to Baslow Woods, *C.* to Chatsworth, *Ca.* to Calton Wood, *G.* to Grindleford, *H.* to Highlow Wood, *P.* to Padley Wood, *S.* to Stoke Wood.

Ceratiomyxa fruticulosa (Müll.) Macbr., *B.*
Physarum nutans Pers., *B.*, *C.*, *H.*, subsp. *leucocephalum* Lister, *B.*
P. viride (Bull.) Pers., *H.*, *Ca.*
**P. psittacinum* Ditmar., *C.*

**P. didermoides* (Ach.) Rost., var. *lividum* Lister, *Cheedale.*
Fuligo septica (L.) Gmel., *B., C.*
Craterium minutum (Leers) Fries., *B., S.*
C. leucocephalum Ditmar., *B.*
Didymium nigripes Fries., *B., C.*
**D. melanospermum* (Pers.) Macbr., *B.*
D. squamulosum (A. & S.) Fries., *B., C.*
Mucilago spongiosa (Leyss.) Morg., *B.*
**Colloderma oculatum* (Lipp.) G. Lister, *C.*
Stemonitis fusca Roth., *B., C.*
**S. herbatica* Peck, *C.*
**S. ferruginea* Ehrenb. *C.*
Comatricha nigra (Pers.) Schroet., *B., C., G., H., P.*, var. *alta* Lister, *S.*
**C. elegans* (Rac.) Lister, *Ca.*
**C. typhoides* (Bull.) Rost., *C.*
Lamproderma scintillans (Berk. & Br.) Morg., *B., C.*
Lindbladia effusa (Ehrenb.) Rost., *C.*
Cribraria argillacea Pers., *B., Ca.*
C. rufa (Roth.) Rost., *C., G.*
C. vulgaris Schrad., *C.*
**Licea pusilla* Schrad., *P.*
Tubifera ferruginosa Gmel., *B., H.*
Enteridium olivaceum (Ehrenb.) Rost., *H.*
Reticularia Lycoperdon Bull., *C., H.*
**Liceopsis lobata* (Lister) Torr., *C.*
Lycogala epidendrum (L.) Fries., *H.*
**Trichia verrucosa* Berk., *G.*
T. affinis de Bary, *C.*
T. persimilis Karst., *B.*
T. varia Pers., *B., C., G., H.*
T. decipiens (Pers.) Macbr., *S.*
T. Botrytis Pers., *C., H.*
**Hemitrichia clavata* (Pers.) Rost., *C.*
Arcyria cinerea (Bull.) Pers., *H.*
**A. pomiformis* (Leers) Rost., *B., C., G., P.*
A. denudata (L.) Wettst., *B., C., H.*
A. incarnata Pers., *B., C., Ca.*
A. nutans (Bull.) Grev., *C., P.*
**A. Oerstedtii* Rost., *C.*
Perichaena corticalis (Batsch) Rost., *G., H.*
**P. depressa* Lib., *G., H.*

During the meeting some of our members exhibited interesting specimens which they had recently collected. From the Lake district Dr Adams brought a large growth of *Badhamia rubigi-*

nosa (Chev.) Rost. var. *globosa* Lister, on moss, a form of *Physarum globuliferum* (Bull.) Pers. showing in its pale drab tint an approach to the nearly allied *P. murinum* Lister, *Comatricha laxa* Rost., *Lachnobolus congestus* (Somm.) Lister and *Margarita metallica* (Berk. & Br.) Lister. Mr Knight exhibited a fine development of *Badhamia lilacina* (Fr.) Rost. found in the plasmodium stage on Sphagnum in a bog in North Wales.

LICHENS OF THE BASLOW FORAY.

By A. Lorrain Smith, F.L.S.

The members of the Mycological Society naturally place fungi in the first rank for collection, and districts are chosen for the annual foray in which the fields and woods are likely to yield good gatherings of these fleeting plants: lichens have therefore not been considered in the choice of locality. They flourish only in pure air, and at Selby, in the 1918 foray, their absence was very striking, and was due to the smoke-clouds from manufacturing towns near-by. Better times for lichenologists were expected from Derbyshire, but Baslow lay within the influence of Sheffield smoke and lichens again were scarce. The atmosphere seemed to be absolutely pure, but the presence of sooty impurities was amply manifested by the condition of one's hands after a few hours' collecting.

The first day's excursion, in the immediate neighbourhood of Baslow, yielded the best results. On the stone walls by the road-side, there were numerous specimens of *Placodium flavescens* and allied yellow forms. *Lecanora muralis* and *L. parella* were also found; many of the stones were coated with an undeveloped powdery white thallus. *Cetraria glauca* was curiously abundant on some of the scattered boulders. Higher up on the moor, *Sphaerophorus globosus* was collected, with various poorly developed *Cladoniae* and, on the bare soil, *Lecidea granulosa* and *L. uliginosa*. Chatsworth Park proved especially disappointing, as the trees, which in more favourable conditions would have been covered with lichen growths, were quite bare. *Lecidea fuliginea* was noted on dead timber. Other species collected and determined during the expedition were *Lecanora varia*, *Parmelia perlata*, with var. *ciliata*, *P. omphalodes*, *P. physodes*, *Cetraria aculeata*, *Cladonia coccifera*, *C. fimbriata* and *Baeomyces rufus*.

PLANT SANITATION IN FRUIT PLANTATIONS*.

By F. T. Brooks, M.A.
(University Lecturer in Botany, Cambridge.)

The ideal variety of apple or plum for growth on a commercial scale is one which crops heavily and regularly, is of good quality, and is resistant to disease. Unfortunately it is as rare in the case of fruit trees as in other cultivated plants, for all these desirable qualities to be combined together. Many of the best market varieties of apples and plums are subject to serious attacks of fungoid or insect pests, and it often happens that the most valuable commercial varieties are those which suffer most from disease. Indeed, certain diseases, e.g. canker in apples and silver-leaf in plums, may threaten the very extinction of some varieties grown on a large scale, unless measures are taken to control their ravages. Hence fruit growers must of necessity spend considerable time and money in combating disease unless they are prepared to see their plantations become derelict. Whenever a crop is grown on a large scale and is forced to its best efforts towards productivity, disease will frequently tend to increase beyond the normal unless drastic measures are taken to deal with it on its first appearance. If neglected, disease becomes cumulative and in its latest stages often assumes the character of an epidemic even though the particular malady is not one of an essentially epidemic nature.

Plant diseases, like human ailments, can be dealt with in various ways. The best means of dealing with disease, if one may so put it, is to avoid it altogether. With cultivated plants, this desirable end can usually only be achieved by obtaining varieties which are immune or very resistant to the most serious pests, whether insect or fungoid. Thus in apples, 'Bramley's Seedling' is very resistant to canker, and in plums 'Pershore' is almost entirely immune from silver-leaf. With certain human diseases, e.g. small-pox, an artificial immunity can be conferred by vaccination, but similar methods of establishing immunity in plants cannot yet be applied, chiefly because there is nothing comparable in plants to the blood stream in man with all its latent healing properties circulating rapidly through the body.

* A paper read at the Eastern Counties Fruit Growers Conference, November 1919.

It often happens that varieties of cultivated plants which are specially resistant to disease are poor in quality or in cropping power. The plant pathologist and the cultivator here look for the assistance of the expert plant breeder to make the necessary desirable combinations. As is well known, this has already been done with many annual plants, especially the cereals, with great success, and one looks forward to the time when similar developments will take place with perennial plants such as fruit trees, although success in this direction will necessarily be slower. Again, it does not follow that because a plant is immune from one disease that it escapes attack from other diseases. Thus, Lord Derby apples which are resistant to ordinary canker are liable to serious damage by blossom-wilt, and Pershore plums which are practically immune from silver-leaf are often attacked by the fungus *Fomes pomaceus*—which, however, is fortunately far less destructive than *Stereum purpureum*. It is, therefore, a counsel of perfection to advocate the selection of varieties which are not affected by disease, and so means have to be devised and set in operation for attacking fungoid and insect pests as they appear.

In human illnesses, medical means are often applied to effect a cure. Thus some drug is taken, or injected into the blood, which either exerts a stimulative action enabling the body to throw off the malady, or which, by some directly poisonous effect, kills the parasitic organisms that are the cause of the disease. In plant pathology, however, medical treatment by internal application can only rarely be applied with any hope of success, chiefly, as already stated, because the higher plants possess nothing comparable to the blood stream of animals, the movements of sap in the former being essentially different from the latter. There is, however, a mode of dealing with certain insect and fungoid pests which is of the greatest importance to fruit-growers, and which can be compared in some respects to medical treatment. I refer to spraying with insecticides and fungicides —in the use of which fruit-growers, from the time when the vine-growers of France first began to use copper compounds as a means of protection, have always been the pioneers. As is well known, insecticides are usually most potent when applied just as the pest is emerging from the resting state or at any rate before the insect is abundant in an active condition, but many fungicides must be applied before the appearance of the fungus in an infectious form in order for the leaves and stems to be protected from penetration. Certain pests and diseases, such as aphis in plums and scab in apples, can be entirely, or almost entirely, controlled by spraying. It is not proposed to deal further with the subject of spraying in the present paper, except

to say in passing that much money is sometimes wasted by spraying at the wrong time.

Finally, there are the surgical and hygienic means of dealing with plant diseases. At a time when hygienic measures are assuming increasing importance in the medical profession, it is of interest to point out that these twin phases of plant sanitation have long been the mainstay of the plant pathologist, and probably will long continue to be. Fruit trees in particular lend themselves to surgical treatment when attacked by certain diseases. It is not the case here that if one member of the plant body suffers, all the other members suffer with it, for the unruly limb of a fruit tree can be severed with nothing but benefit accruing to the remainder of the tree. Fire is the strongest weapon in the armoury of the plant pathologist, and notwithstanding that its frequent use in this connection is sometimes slightingly referred to as a primitive and unscientific weapon, and not at all in keeping with the elaboration of the twentieth century, it is undoubtedly the surest destroyer of disease that exists. In plant sanitation, one aims at the eradication of the sources of infection. This is a point of view which should be kept constantly in mind by the cultivator. It may be urged that it is impossible to eradicate completely the sources of infection in the case of the commonest plant diseases. Be that as it may, and certain human diseases such as yellow fever have been wiped out in parts of the tropics solely by the application of sanitary measures, conviction is firm that many of the most serious fungoid pests can be greatly reduced by destroying their breeding grounds which are still often left either within or near fruit plantations. It is a well known fact in medical science that in diseases of parasitic origin like malaria and tuberculosis the magnitude of the dose, so to speak, of the parasite frequently determines whether disease is established or not. If only a few germs are absorbed, the parasite may not be able to establish itself, while if many are taken in, disease will develop rapidly. The same factor operates with certain plant diseases, and many growers here must be familiar with plum orchards which, through neglect in the eradication of branches bearing *Stereum purpureum*—the cause of silver-leaf disease, succumbed in the later stages with amazing rapidity. In such cases, probably the most potent factor is the great abundance of spores shed by the fungus in the immediate vicinity.

The first principle of sanitation in fruit gardens is to avoid as completely as possible any harbourage for the breeding of insect and fungoid pests. This postulates the cutting off of branches which are dying back and their speedy destruction on the spot by fire, or removal from the plantation. If the severed

branches are allowed to remain in the plantation, the fungus which killed them will soon fructify and shed its spores around in the same way as if still attached to the standing tree. Large wood piles are often seen in fruit plantations forming excellent breeding grounds for such a destructive pest as *Stereum purpureum*. In these days of fuel shortage there should be no difficulty in disposing of wood cut out in this way. Not long ago I saw a gigantic pile of red currant prunings in the midst of a large area of red currants, the prunings being literally smothered with the pink fructifications of *Nectria cinnabarina*, which, as many fruit growers know to their cost, is becoming increasingly destructive to red currants. There is no reason why these prunings should not have been burnt as soon as collected. In cutting out diseased branches, action must be sufficiently drastic to ensure that the downward limit reached by the fungus is excised. This is particularly important with silver-leaf disease, the region penetrated by the fungus being marked by a brown discolouration in the wood, which is often a considerable distance below the silvered foliage. In this connection mention may be made of a case seen during the summer: the branches of certain silvered 'Lord Grosvenor' apple trees had been cut back, but not far enough, as the fungus *Stereum purpureum* was developing in quantity from each of the exposed extremities. We have not infrequently seen silvered trees the upper parts of which have been lopped and the trunks left standing and bearing enormous quantities of *Stereum*. Such a practice cannot be too strongly condemned. Where large branches are severed, the exposed surfaces should be made smooth and covered with tar to prevent the ingress of wound parasites. While on the subject of branch infection by silver-leaf, it may be mentioned that it is usually the wisest economy to cut out silvered branches as they appear, i.e. before they die back; there is then not the slightest opportunity of the fungus fructifying through delay in cutting out the dead wood.

With other diseases there is often no means of telling that a parasite has entered the tree until the branches begin to die back and fructifications of the fungus appear. This is particularly the case with the die-back of plums and cherries caused by the fungus *Cytospora leucostoma* and the affection of plums due to *Fomes pomaceus*. In such, drastic action can only be taken upon the appearance of the first external signs of disease, when the greater part of the trees can often be saved, if excision is effected judiciously. While dealing with the subject of excision, it is recommended that, in soft-wooded varieties such as the 'Victoria' plum, the branches of which frequently break through overcropping, broken limbs should be cut back flush

with a larger branch or main stem immediately after removal of the fruit. It is the ugly wounds of broken branches which offer special facilities for the entrance of wound parasites such as *Stereum purpureum*.

Where a tree is dying back to such an extent that its loss is inevitable, it is important that the stump should be removed if possible at the time of felling. Unlike the forester, the fruit-grower is little troubled by the action of root parasites, but nevertheless the stumps and the larger roots should be removed in order to prevent the growth of suckers and for the future convenient working of the plantation. If the stump cannot be removed, it should be covered with soil to prevent the development of dangerous fungi such as *Stereum*. In the case of plum trees removed on account of silver-leaf disease one has always hitherto hesitated to suggest the planting of other susceptible varieties of plum on the same site, but during the past summer considerable areas have been seen in which young 'Victoria' plums have been planted where older silvered trees have been removed; these young trees have remained healthy up to the present, i.e. for a period of 2 or 3 years. Although one is not in a position at present definitely to recommend this course, there seems to be no undue risk in replanting with the same variety, if this is desirable for other reasons, and provided the stumps of the diseased trees are removed.

As time proceeds, greater care will probably be devoted to the control of such diseases as brown rot of apples and plums which in certain seasons levy a heavy toll on the fruit. In the main, this trouble is carried over from season to season by fruits which, mummified by the action of the fungus, hang upon the trees during the winter or lie on the ground. Where brown rot is liable to be severe, it would be worth while to have these mummified fruits collected and destroyed during the winter. Another closely allied disease, the blossom-wilt which Wormald has shown severely affects 'Lord Derby' apples, can be dealt with by the excision of the affected spurs. It has been demonstrated that this operation of removing the diseased spurs is commercially profitable. Again, the common scab fungus, *Fusicladium dendriticum*, usually hibernates in the young twigs of the most susceptible varieties of apples, and while pruning is being done, care should be taken that all the twigs which show small pustules in the bark should be cut off. With the common canker caused by *Nectria ditissima* it is generally recognised that this disease is chiefly dependent upon the nature of the variety and the conditions of the soil. There is evidence too that the influence of the stock is not inconsiderable in this connection. The wise fruit-grower will therefore select his varieties accordingly.

Excision of cankered areas is undoubtedly profitable in some cases, particularly in young trees, as this trouble, like most others, becomes cumulative if neglected.

Care must be taken to prevent the development of dangerous fungi not only within the plantation but also in its immediate vicinity. On more than one occasion I have seen silvered sloe trees with the fungus *Stereum purpureum* developing on the dying branches, in hedges bordering plum plantations. It is obvious that such trees should be removed, as well as any other, such as laburnum, which happen to develop silver-leaf disease. The stumps of elm trees in hedgerows are a prolific source of the same species of *Stereum* and it is known that the fungus from this source is just as dangerous in causing silver-leaf as is *Stereum* taken from a dying ' Victoria ' plum. Stumps of practically all broad-leaved trees with the exception of oak are liable to give rise to profuse growths of this fungus. Such stumps should be eradicated, charred, or covered with soil if they are on the borders of fruit plantations. Fruit gardens situated in the midst of agricultural land are more favourably placed as regards danger of attack by wound parasites than are plantations near woods, in which most of these fungi find an excellent harbourage. There is no excuse, however, for such a practice as that of making fences of plum wood around fruit plantations. That is simply asking for trouble. I once saw a fence, made of plum wood, separating one plum plantation from another, which was literally covered with the fructification of *Stereum purpureum*. Can it be wondered at that silver-leaf disease was rife in both these gardens? In another place, a number of half-standard plums were tied up to stakes made of birch stems on which *Stereum* was developing in abundance.

With a few diseases such as plum rust and black currant rust, the fungus completes its life on two different kinds of plants. Thus in the plum rust, the fungus lives indefinitely in the perennial parts of the commonly cultivated Anemone, *Anemone coronaria*, in the leaves of which spores are produced in the spring, which in turn affect plum leaves. Unless, therefore, the diseased anemones are eradicated, there is no means of preventing attacks of plum rust in the immediate vicinity. Some years ago, I saw a very severe attack of plum rust in fruit orchards near a florist's garden in which diseased anemones were known to be present. So severe was the plum rust that the trees were defoliated by the end of August. More recently, the florist's garden has been converted to other purposes and plum rust has been scarcely noticeable in the vicinity. One is strongly inclined to suggest cause and effect as operating here. With black currant rust, in which the effect of a bad attack is

less noticeable, the alternate stage of the fungus grows upon Weymouth pines, which it gravely injures. Here again diseased Weymouth pines should not be allowed to occur in the neighbourhood of fruit gardens. If a comprehensive system of inspection of plant diseases is ever instituted in this country, these are two of the diseases which will have to be kept under observation, for although they are not at present a menace to the fruit-grower, they have dangerous potentialities.

The remarks just made with reference to market plantations apply with even more force to nursery gardens. The nursery is the foundation of all sound fruit growing, and this country is fortunate in possessing many firms of nurserymen who have the highest possible sense of responsibility to their customers. If one imagines what might have been distributed by way of disease and by poor quality stocks by untrustworthy people, the effective manner in which the nurseries have firmly established the market fruit-growing industry in this country will be at once recognised. Nurserymen should deal even more drastically with disease than the market grower. If silver-leaf happens to appear, the affected plants should be immediately burnt. It must be recognised that some of the operations carried out in the nursery necessarily entail a risk of infection by wound parasites. Thus in budding and grafting, the exposed tissues may be penetrated by *Stereum purpureum* with the result that silver-leaf disease develops. It is sometimes the practice in budding young nursery stuff to leave a long stub belonging to the stock, to which the developing bud can be tied, thus obviating the necessity of staking. While this practice is almost entirely innocuous with apples, it is fraught with some danger to plums and peaches, especially if these are worked on the 'Brompton' stock which, it is well known, is very susceptible to silver-leaf. It would probably be a sounder practice to cut back the stub, cover the exposed end with grafting wax or with an antiseptic, and tie the developing bud to a stake. That great care is taken generally by nurserymen in eradicating silver-leaf if it happens to appear in the nursery, is evidenced by the fact that it is very rare to see silvering in plum trees under 5 years of age.

Persons who only occasionally grow stocks and work them may perhaps take less care in avoiding disease than the regular nurseryman. Statements have been made that silvered suckers are sometimes taken from diseased plum plantations to be used as stocks, and although reputable nurserymen would not countenance such a practice, provision should certainly be made to prevent the possibility of silvered suckers being used as stocks. If any wide system of nursery inspection is contemplated

in the future, care must be taken, in fairness to the established firms, that those persons who grow stocks for a year or two spasmodically are also subject to its provisions.

There remains to be discussed the best time for carrying out these operations. Whenever a disease is seen, the motto "Do it now" applies with great force to whatever measures may be contemplated. If labour conditions permit, the best time for action on the above lines is during the summer when there is a clear differentiation between healthy and diseased branches. Furthermore, the wounds made by severing branches then have a chance of partly healing before the winter. Action during the early summer is specially important in dealing with silver-leaf, because it is well known that the fructifications of *Stereum purpureum* are produced in greatest abundance on the dead wood during the latter part of the summer and autumn. While pruning and thinning out are taking place during the winter a second opportunity is afforded of dealing with some of the pests which have been briefly mentioned. If, however, labour conditions do not permit of cutting out dead wood during the summer, excision must be left until the autumn and winter.

In large areas of fruit there is a great deal to be said for placing the operations of plant sanitation, spraying, and pruning in the hands of an expert with a gang of men under him. The expert is often anathema to the practical man, but the time seems to have come in large market fruit-gardens, when there is a great deal to be said in favour of a division of labour, the respective portions of the work being in charge of men of special training. In districts where small fruit plantations are the rule, much might be done in the same way by co-operative effort. In the case of the rubber plantations of the East—of which I happen to have some knowledge—there is upon every estate of importance what is known as a pest gang whose sole duty is to watch for and treat disease as soon as it appears. This pest gang is either officered or supervised by a European under whom are one or more intelligent natives who direct the coolies as to what is to be done. In the tropics, sanitary measures of the same kind as those outlined above, are considered of the greatest possible importance, and one of the chief anxieties of the managers of these estates is in seeing that the pest gang is adequately doing its work. Of course most of these rubber estates are much larger than fruit gardens in this country—many of them exceed 1000 acres, but so important is the question of combating disease now considered to be, that some of the largest estates employ a fully trained plant pathologist in an advisory capacity, in addition to the Government staff which is always available. As stated above, there is much

reason in the fruit-growing industry for placing spraying, pruning, and sanitary measures in the hands of a separate labour unit controlled by a man with special knowledge.

Although particular stress has been laid upon certain sanitary measures in controlling some of the diseases that attack fruit plantations, other measures such as winter washing, and grease banding, are of equal importance in diminishing the activities of certain pests, but these subjects have often been dealt with and there is no time for their consideration now. Of primary importance too in the well-being of fruit gardens are adequate drainage, sufficiently wide spacing of the trees to allow of the free circulation of light and air, and reasonably good cultivation of the soil. On the last topic one word may be ventured. It is known that rapidly acting nitrogenous manures induce a succulent type of growth which readily falls a prey to fungoid disease, while on the other hand slow-acting manures such as basic slag and shoddy tend to promote growth in the trees, which rapidly ripens and is less susceptible to parasitic attack.

It may be asked whether the sanitary measures dealt with in this paper are economically sound. The universal test of every commercial operation is the question whether it pays or not. It may be urged that in the long run greater profits will be made where diseases are allowed to run their course in view of the cost of the operations briefly described in this paper. But he would be a bold man to-day who ventured to assert this, and all who have seen plantations of 'Victoria' plums rendered completely derelict by neglect of silver-leaf disease will agree in stating that sanitary measures in fruit gardens are worth while and serve as the best means of insurance for the future. Progressive fruit-growers have long recognised this, but their efforts towards cleanliness in their plantations are sometimes partly discounted by apathy on the part of their neighbours. Those growers, for instance, who neglect silver-leaf disease are a menace not only to themselves, but to their fellow cultivators. The time has come when a person who allows trees killed by silver-leaf disease to remain standing and be the means of propagating the insidious fungus which causes it, will be looked upon as committing a nuisance for which there must be pains and penalties. Public opinion amongst fruit growers, however, can do more good towards introducing proper treatment for the troubles occasioned by disease than all the legislation in the world. It is a pleasure to note that a healthy public opinion in this respect is rapidly developing amongst fruit growers.

With silver-leaf disease, measures of plant sanitation can alone be used at present as a means of control. These measures are simple and easy to carry out, and I am convinced after much

experience of the disease and its treatment, that the disease can be effectively controlled in this way. Silver-leaf and similar troubles are sometimes looked upon as "Acts of God" for which there is no treatment, or else alarm is raised and some nostrum is requested in a hurry which will cause recovery in trees that are already doomed and dying. The cry has been raised that the cultivation of the valuable 'Victoria' plum will be wiped out by the spread of silver-leaf disease. Nothing of the kind—that is, if the measures advocated in this paper are effectively pursued. Where plantations of 'Victoria' plums have been killed by this disease, there has always been terrible neglect, but one hopes that such gardens will soon cease to exist in all the important fruit-growing districts of the country.

A DRAIN-BLOCKING FUNGUS.

By A. Lorrain Smith, F.L.S.

In September 1919, material was submitted to me that had been taken out of a sewer in the City of London 30 feet below ground, and under the vaults of a bank previously the site of Crosbie Hall. The whole mass weighed about ½ cwt. and had completely closed the drain-pipe. The substance was sodden with water and of a uniform brownish-yellow, but there was no difficulty in recognising its fungus nature and that it was a *Fomes*. As the fungus dried, layers of white pileus and long cinnamon-coloured tubes became visible. The specimen was exhibited a few days later to the members of the Mycological Society at their annual meeting at Baslow, and Mr Carleton Rea unhesitatingly pronounced it to be *Fomes ulmarius*, a fungus which has always been considered to grow on elms.

There is at the present date no living elm in the neighbourhood of Crosbie Square. Search was made, while tunnelling to remove the obstruction, for any material on which the fungus could have originated; the gap in the pipes was found by which the fungus had penetrated into the pipe; and near to this lay a piece of timber of coniferous wood. The wood was fairly rotten and the cells occupied by mycelium, but there was no sufficient evidence that the fungus had any connection with this wood. Mr Rea tells me that elm roots travel long distances and he has had experience of drains being blocked by the roots of an elm tree

50 or 60 yards away. It may be that remains of elm roots or timber are present in the soil. It might also be possible that the fungus had lived on the coniferous wood. The *Fomes* was found in four different places; it has now been removed at great cost and trouble.

STUDIES IN DISCOMYCETES II.

By Jessie S. Bayliss Elliott, D.Sc. (Birm.), B.Sc. (Lond).

5. *Dasyscypha conformis* (Cooke) Sacc.

During the last two years I have often found on the dead stems of rushes *Erinella apala* (B. & Br.) Sacc. growing very plentifully and also *Dasyscypha conformis* (Cooke) Sacc.; sometimes both were growing together on the same clump of rushes. Massee (British Fungi, Vol. iv. p. 334) states that the latter species was unknown to him and also that he was unable to find the type specimen in Cooke's herbarium. Both Discomycetes are very similar except in microscopic characters, but after meeting the two frequently, one recognises readily with a hand lens *D. conformis* by its larger size and its sessile or very shortly stipitate form (fig. 3). It has been suggested that *D. conformis* might be an immature form of *E. apala*: but after studying both species I find the microscopic characters of the two very distinct.

Since Cooke's description of *D. conformis* copied by Massee is very incomplete and also has inaccurate spore measurements, I think it would be useful to describe the fungus again.

D. conformis. Gregarious or scattered, sessile or very shortly stipitate, ·75–1 mm. diameter, cupulate becoming plane, fawn colour, covered with short, wide, colourless, obtuse, clavate, aseptate hairs filled with oil drops when fresh; excipulum parenchymatous, cells oblong; asci subcylindrical, 65–70 × 7μ, apex obtuse, spores slenderly lanceolate 14–20 × 1·5μ, one or two seriate, straight, sometimes slightly curved; paraphyses acerose, exceeding the asci, some narrow, others wide—5μ, filled with oil drops when fresh (figs. 3, 4, 5, 6).

E. apala is distinguished from the above by the much longer spores arranged in a fascicle, the septate paraphyses which project further above the asci than do those of *D. conformis*, and also by the long narrow tapering hairs which surround the margin and cover the excipulum, and which form a sharp contrast to the obtuse clavate marginal hairs of *D. conformis* (figs. 7, 8.)

6. *Orbilia leucostigma* Fr., v. *xanthostigma* (Fr.) Rehm.

I have found this fungus very frequently growing luxuriantly and examined many specimens, also I have had it under observation while growing for many months. The form of the spores is described as elliptical or egg-shaped by Massee, Rehm and Saccardo; this description is misleading and incomplete since they are decidedly U-shaped: when the two ends of the U are in view the spores appear as two circles (o o) and only when the curved top of the U is in focus can they be called elliptical (figs. 9, 10). In Boudier's Icones they are figured as U-shaped.

This fungus seems to me identical with *O. coccinella* (Somm.) Fr. the spores of which are said to be slightly wider, being given as 3–4 × 2μ, thus having only a trifling difference from 3–4 × 1·5μ (Massee) or 3–4 × 2–3μ (Boudier), the measurements of *O. leucostigma* v. *xanthostigma*; also the colour distinction is insignificant. *O. coccinella* is described as blood red or deep orange red while *O. leucostigma* v. *xanthostigma* is said to be yellow with sometimes a tinge of red when fresh. The specimens which I find usually vary from yellow to deep orange and often there is a sprinkling of whitish translucent forms among them while, when dry, a blood red colouration is usual, but this varies and is sometimes yellow; I have seen them just as blood red as those figured by Boudier as *O. coccinella*.

Although Boudier figures spores of *O. coccinella* as ellipsoid, in Engler and Prantl two figures of the spores are given, the one (profile view) showing a very curved, almost a U form, the other elliptical; thus all characters considered there is no real distinction between *O. leucostigma* v. *xanthostigma* and *O. coccinella*.

7. *Pyrenopeziza plicata* Rehm (= *Mollisia plicata* (Rehm) Sacc. sec. Boud.) f. *conicola*.

Ascophores scattered and crowded, $\frac{1}{2}$–$\frac{3}{4}$ mm. diameter, sessile, or when young very shortly stalked, closed and almost globose at first, becoming saucer-shaped or even repand when old; disc greyish, margin whitish, fimbriate, hairs septate and obtuse; excipulum olive brown or blackish, parenchymatous, rough with rounded hair-like outgrowths from the cortical cells, often more or less vertically wrinkled; asci cylindrical, apex somewhat narrowed, 80 × 6μ; spores oblong, fusiform, hyaline, continuous, straight, or slightly curved; two seriate; 10–12μ × 2μ; paraphyses slender, hyaline, equal, 2μ wide and same length as the asci (figs. 11, 14, 15, 17).

The apothecium is often attached to the substratum by a fringe of colourless hyphae (fig. 11*a*).

Habitat. Cones of *Pinus sylvestris.* Tanworth-in-Arden.

This is closely allied to *P. Mercurialis* (Fuck.) Boud., and also to *Mollisia atrata* (Pers.) Karst., with its numerous varieties, and allied species whose habitats are herbaceous stems.

Growing on the same cone in close relation with this Discomycete were crowds of small black pycnidia belonging to the genus Phoma and on the older specimens of these the young apothecia of the Discomycete could be seen, growing either out of the top or the sides (fig. 11); the inference seems justifiable that these pycnidia are the conidial stages of the Discomycete; the external appearance of the pycnidia even in microscopic detail resembles that of the Discomycete.

The pycnidia are erumpent and in many instances a scar similar to the one seen in connection with the pycnidium was also to be seen below the apothecium (fig. 11).

Phoma conicola. Pycnidia erumpent, gregarious or scattered spherical, ·2 mm. diameter, sessile, olive brown or black, excipulum parenchymatous, rough with round hair-like outgrowths from the cortical cells, similar to the excipulum of *Pyrenopeziza plicata* Rehm f. *conicola*, at first closed, then open, margin fringed with septate colourless hairs which converge: pycnospores colourless, oblong 3 × 1–1·5μ, some slightly bent, continuous, situated on short conidiophores, arising from the walls of the pycnidium (fig. 11*b*, 12, 13, 16, 18).

Habitat. Fallen cones of *Pinus sylvestris.* Tanworth-in-Arden.

Under very moist conditions the pycnospores ooze out and form a glistening white ball on the top of the pycnidium: this elongates, topples over and the pycnospores are dispersed in the surrounding moisture: they germinate within twenty-four hours in rain-water (fig. 18).

The pycnidia need far moister conditions for development than the apothecia, and by varying the humidity of the moist chamber containing a cone on which both of these forms were growing, either the one or the other prevailed.

Pyrenopeziza plicata Rehm has previously been found in Britain, but apparently not recorded. I have seen specimens from the herbarium of W. B. Grove collected by him at the Edge Hills on dead *Angelica* stems, 1884, and by C. B. Plowright collected at Kings Lynn on some dead herbaceous stems in 1873.

Phoma conicola n. sp.

Pycnidia gregaria vel sparsa, erumpentia, sphærica, 0·2 mm. diam., sessilia, olivaceo-brunnea vel nigrescentia, excipulo parenchymatico, vesiculis e cellulis extimis oriundis obsito, ei Pyrenopezizæ simillimo, primo clausa, dein aperta, margine pilis achrois septatis convergentibus fimbriato. Sporulæ

achroæ, oblongæ, 3 × 1–1·5μ, interdum curvulæ, continuæ, sporophoris brevibus suffultæ.

8. *Hyalinia Leightoni* (Phill.) Boud. v. *lignicola.*

Scattered or crowded, confluent, sessile, glabrous, diaphanous, translucent, depressed or almost plane 1 to 1·5 mm. diameter; when dry angularly contracted with margin sometimes raised; hymenium whitish, excipulum parenchymatous and fuscous: asci cylindrical, apex narrowed 100 × 8μ; spores 8–13 × 2·5–3μ, elliptical with blunt ends, irregularly one or two seriate; paraphyses filiform, branched, same length as asci, ·5μ wide (figs. 1, 2, 28, 29, 30).

Habitat. Decaying wood. Plowden near Shrewsbury, Sept. 1917.

This fungus seems to differ very little from *Calloria Leightoni* found by Phillips growing on a Polyporus, and which does not appear to have been seen since: it seems advisable however to consider it a variety as the substratum is very different, and the colour fuscous instead of yellow or white.

9. *Calloria extumescens* Karst.

Gregarious or often confluent, ·3 to ·5 mm. diameter, sessile, globose at first becoming plane or slightly concave, glabrous, sub-gelatinous when moist, excipulum formed of anastomosing hyphae, bright yellow when young, becoming flesh coloured or reddish brown; asci cylindrical clavate, 60 × 6μ; spores hyaline continuous or uniseptate (rarely more) 10–13 × 2μ, elliptical, ends rather acute; paraphyses filiform, 1–1·2μ (figs. 23, 24, 25, 26, 27).

Habitat. On decaying oak. Bomere near Shrewsbury, Sept. 1917.

This agrees with Karsten's description of *C. extumescens* but according to Rehm the excipulum should be parenchymatous. Karsten does not describe the excipulum.

This fungus is also near *Mollisia Mali* (Rehm) Phill. (= *Urceolella Mali* (Rehm) Boud.) but differs in the confluent apothecia, the uniseptate spores, which sometimes even have two septa, also the colour which although bright yellow when quite young becomes flesh-coloured and reddish brown later.

10. Mollisia Populi n. sp.

Gregarious, sessile, saucer-shaped, becoming plane and revolute, 1–2 mm. diameter, hymenium grey when young, pinkish or ochraceous when older; excipulum grey with an olive tinge, parenchymatous, margin fimbriate, asci cylindrical, 90–100 × 7–10μ, apex narrowed, short pedicel, spores two

seriate, hyaline, narrowly fusiform, straight or slightly curved, continuous, one septate, 20–25 × 2–3μ; paraphyses containing oily protoplasm in the terminal cell, hyaline, stout, septate, thickened upwards to 7–8μ wide, apex narrowed length not exceeding the asci.

Habitat. On dead twigs and branches of poplar. Tanworth-in-Arden.

This fungus has some points of resemblance with *M. atrata* (Pers.) Karst. v. *eupatoricola* (Phill.), including the large conspicuous paraphyses, but it grows on wood not herbaceous stems, it is a bigger fungus, and its spores are longer varying from 20–25μ, instead of 10–18μ.

It also somewhat resembles *Niptera ramealis* Karst. (= *Mollisia ramealis* Karst. sec. Boud.), but although the spores are within Karsten's wide limits of 14–30μ, they are not blunt at the ends neither are the paraphyses thread-like, being much wider than the outside limit given (3μ), being as wide as the ascus, 7–8μ.

Rehm considers *N. ramealis* Karst. the same as *Belonidium ventosum* (Karst.) Phill. (*M. ventosa* Karst. sec. Boud.); if that is so, the above fungus differs considerably since it has a parenchymatous excipulum and a fimbriate margin in contrast with the excipulum of interwoven hyphae and smooth margin of *M. ventosa*, also the spores are larger and the paraphyses very different.

This fungus was found in August 1917, growing on branches which had been pruned from a flourishing young poplar tree less than two months previously, and left lying in a heap on the ground.

Mollisia Populi n. sp.

Gregaria, sessilis, patelliformis, dein plana ac revoluta, 1–2 mm. diameter; hymenium junius cinereum, senius incarnatum vel ochraceum; excipulum olivaceo-cinerascens, parenchymaticum, margine fimbriato. Asci cylindrici, 90–100 × 7–10μ, apice attenuato, pedicello brevi. Sporidia biseriata, hyalina, anguste fusiformia, recta vel leviter curvata, continua, 1-septata, 20–25 × 2–3μ; paraphyses haud ascos superantes, hyalinæ, amplæ, septatæ, superne ad 7–8μ incrassatæ, apice ipso attenuatæ.

I wish to express my thanks to Mr W. B. Grove, M.A., for useful criticism and help in various ways and also to the late Prof. G. S. West for the loan of books of reference.

DESCRIPTION OF PLATE VI

Fig.

1. *Hyalinia Leightoni* v. *lignicola*. Asci and paraphyses.
2. Parenchymatous excipulum of *H. Leightoni* v. *lignicola*.
3. *Dasyscypha conformis*. Apothecia.
4. Ascospores.
5. Clavate marginal hairs and parenchymatous excipulum.
6. Aseptate paraphyses containing oil drops and asci.
7. *Erinella apala*. Septate paraphyses and ascus containing a fascicle of ascospores.
8. Tapering marginal hairs incrusted with crystals.
9. *Orbilia leucostigma* v. *xanthostigma*. Ascospore.
10. Asci containing ascospores.
11*a*. *Pyrenopeziza plicata* f. *conicola*. Apothecia.
b. Pycnidia of *Phoma conicola*.
The apothecia are to be seen growing among and arising from the pycnidia.
12. Young pycnidium of *Phoma conicola*. The young apothecium of *P. plicata* f. *conicola* is similar in all detail.
13. Pycnospores oozing out of a pycnidium.
14. Asci and paraphyses of *P. plicata* f. *conicola*.
15. Section through young apothecium of *P. plicata* f. *conicola* showing the rounded hair-like growths on the excipulum.
16. Section through young pycnidium of *Phoma conicola*.
17. Apothecia of *P. plicata* f. *conicola* on cone.
18. Pycnidium of *Phoma conicola* with the rounded glistening mass of pycnospores imbedded in mucilage.
19. *Mollisia Populi*. Apothecia.
20. Ascospores of *M. Populi*.
21. Excipulum with fimbriate margin.
22. Paraphyses—narrow and wide varieties; also ascus containing ascospores.
23. *Calloria extumescens*. Confluent apothecia.
24. Excipulum formed of anastomosing hyphae.
25. Apothecia of *C. extumescens*.
26. Asci and paraphyses.
27. Ascospores, continuous and uniseptate.
28. *Hyalinia Leightoni* v. *lignicola*. Apothecia.
29. Apothecia, crowded and confluent.
30. Ascospores.

ON THE FORMATION OF CONIDIA AND THE GROWTH OF THE STROMA OF DALDINIA CONCENTRICA.

By Jessie S. Bayliss Elliott, D.Sc (Birm.), B.Sc. (Lond.).

The curious charcoal-like sporosphore of *Daldinia concentrica* have often attracted the attention of mycologists and several have kept it under observation for more or less lengthy periods and have also cultivated it and noted points of interest in its life history. In 1863 Tulasne* published an excellent description of the ascophore also noting the presence of conidia on it previous to the formation of perithecia. In 1901 Möller† published the results of his observations on the rapidity of growth of the stroma and the duration of spore production. He also germinated ascospores and obtained the conidial condition in his cultures. In 1904 Molliard‡ published a paper describing how he had obtained the conidial form by sowing ascospores on pieces of carrot enclosed in tubes. Again, in 1913, Brooks§ in a paper describing some culture experiments he had carried out refers to finding conidia on blocks of ash which he had infected with ascospores. Descriptions of the ascophore are also given by Rabenhorst||, Berkeley, Cooke and others.

For more than five years I have had under observation logs of ash on which both the conidial and perithecial forms of this fungus appeared from time to time. The conidial form was to be seen during the spring, summer and autumn months as a cream-coloured incrustation (figs. 35, 36) several sq. centimeters in area both on the bark and on the sawn ends of the logs, chiefly in the damper parts where they touched the ground and in parts shaded by grass: its surface had a coarsely villose appearance (fig. 36) owing to the tendency of the conidiophores to mass together and form small stromata about 3 or 4 mm. high by 1·5 mm. broad (fig. 36). Colourless conidia were produced in great quantities giving the patches a powdery appearance; the

* Tulasne. Selecta fungorum Carpologia, T. II.

† Möller, A. Phycomycetes and Ascomycetes. In Schimper, A. F. W., Bot. Mitth. aus den Tropen, Heft 9. Jena, 1901.

‡ Molliard Marin Forme conidienne de Daldinia concentrica. Bull. Soc. Myc. de France. Tome XX, 1904, pp. 55–60.

§ Brooks. Observations on pure cultures of some Ascomycetes and Basidiomycetes. Trans. British Mycological Society, 1913.

|| Rabenhorst. Kryptogam. Flora. Band I, Abth. 2.

conidiophores are much branched and since the branches come off in a verticillate manner and terminate in clusters of conidia (figs. 31, 33) the fungus is evidently a species of Botrytis. On one of these conidial areas small hemispherical nodules with a rich brown velvety covering appeared (fig. 36). These on being cut showed the characteristic zoning of *Daldinia concentrica*. One produced ten zones in three weeks and the cut surface examined three weeks later was found to be covered by the conidial form but on being cut again ceased to grow.

Tulasne describes the presence of conidia on the stromata previous to the formation of perithecia; I have examined many specimens while growing and have only come across traces of this except on stroma of exceedingly small diameter, 3 mm. or less; whereas the creamy conidial patches on bark (fig. 35) which appear before or at the same time as the ball-like stromata are quite common on ash logs.

During the Selby foray this year (1918) both at Byram Park and Garforth patches of conidia were very abundant in close proximity to the sporophores, and also quite apart from them, on the ash logs which lay scattered about so plentifully.

Although this conidial form is so common, it is not recognised as belonging to the perithecial stroma, nor does it appear to have been recorded as a Botrytis: as already mentioned several investigators have obtained it by infecting culture media with ascospores, and one, Molliard, recognising its systematic position has proposed to call it *Nodulisporium* (*Botrytis*) *Tulasnei*; but he considered it was unlike any described species, possibly through being grown under artificial cultural conditions.

The conidia are colourless and measure 6·5–8 × 5–6μ.

Culture experiments. Large chunks of ash after being sterilised were infected with conidia as were also small chips in tubes;—some of these chunks were placed out in the open, others were kept in the laboratory. In the laboratory a fluffy mycelium appeared on them which although white at first gradually became black; when after eighteen months these chunks were placed out in the open air on grass in the shade, the black mycelium disappeared and the characteristic villose conidial patches appeared; the cultures which from the start were out in the open within three months produced conidia but no black mycelium: the conidial patches always became brown. Large patches 10 sq. cm. or more have appeared every year on these infected blocks but as yet no perithecial stromata have been seen; the blocks are still in a very sound condition unlike the log on which the perithecial sporophores appear which is in an advanced stage of decay.

The perithecial stroma. As long as the stroma is growing the

exterior is brown in colour and it only becomes black when it ceases growth; at this stage the whole stroma is exceedingly brittle and carbonaceous especially the exterior layer, about ·5 mm. in thickness, which is so hard that it is difficult to force even a sharp needle through it, but the interior remains quite soft and has a somewhat fibrous texture. The *zoning* so characteristic of this fungus is due to the formation of successive layers of perithecia. Perithecia are continually being formed in the stroma just immediately beneath the thin hard external layer (fig. 36); they are to be seen even in stromata of 3 or 4 mm. diameter but only those of the last formed zone reach maturity; the outlines of previously formed perithecia (fig. 34) are to be observed more or less distinctly in the zones near the exterior; these are easily recognised because the hyphae forming the walls of the perithecia turn black some time before the hyphae which form the bulk of the stroma.

Although actual experiments were not carried out, from various observations there seems reason to believe that the periods of perithecial maturation correspond with periods of diminished humidity while increase in humidity brings about active growth which ultimately leads to the formation of a new perithecial zone and atrophy of the perithecia of the preceding zone.

It is quite recognisable that the fibrous nature of the interior of stromata is due to these perithecia which never attain maturity: some zones in consequence of the perithecia having attained quite an advanced stage of growth before renewed growth of the stroma occurred have quite a porous appearance owing to the numerous large sterile perithecial cavities there.

Although in section mature stromata look a smoky-brown colour, while growing the last four or five zones are seen to be zoned alternately black and white: the black zones owe the dark appearance to the abundant perithecia there, the walls of which are always nearly black (fig. 34).

The hard exterior is exceedingly protective for a stroma becomes immediately mined by slugs when cut, or after being cracked by frost: the stromata crumble away during the winter and so do not last more than one year.

Very young stages in the formation of perithecia are difficult to observe because they are formed close under the dark brittle protective outer layer of the stroma: in the youngest which could be clearly distinguished small spherical masses of hyphae (figs. 38, 39) were seen which consisted of an external covering tissue of densely woven, very narrow, thin walled hyphae, surrounding a central hyphal mass of very wide septate hyphae: the latter formed an irregular coil of several turns and doubtless functioned as ascogenous hyphae: very similar structures are

to be seen in sections of young perithecial stromata of *Xylaria polymorpha*, Ustulina and other fungi: the densely woven covering tissue eventually turns black and forms the wall of the imbedded perithecia.

Stages of development earlier than this were somewhat indistinct, but they suggested that the coiled hypha arose from two similar very transparent hyphae (fig. 38) which stain very deeply with haematoxylin, one of which curved closely against the other and are analogous to the simple form of gametangia seen by Barker* in Monascus: at this stage the thin walled covering tissue was not yet formed.

Spore discharge extends over several weeks in detached stromata and black ascospores are produced in vast quantities. In the quiet atmosphere of a culture chamber long coiling threads of ascospores 10 or 15 mm. or longer are extruded from the mouths of the perithecia (fig. 37) which closely crowded together cover the whole exterior of the stromata. The coiled threads look very like the threads of pycnospores which are produced normally from mature pycnidia of the Sphaeropsidaceae, but they are not formed in the same way and are really abnormal. If one of these threads be observed under the microscope it will be seen to issue from the mouth in a jerky manner and on brushing aside such a thread, asci can be seen coming up to the orifice one at a time and discharging themselves one after another. The discharge goes on very rapidly and the ascospores from one ascus follow so closely on those from the preceding one that in a quiet atmosphere they stick together and a long coiling thread is produced (fig. 37), consisting of symmetrically arranged ascospores (fig. 32), for each series of eight ascospores lies parallel with another series of eight and the eight ascospores of each group can be seen adhering to one another. Sometimes an ascus appears quite a third its length above the orifice before discharging.

Under natural conditions air currents would prevent the formation of these coiled threads, for the contents of one ascus would be blown away before the discharge of the next ascus took place. Even in a quiet atmosphere the coiled threads of ascospores are not formed if the discharge of asci is taking place slowly; for by placing slips of white paper a centimeter or so above the surface of a ripe sporophore, after about an hour black ascospores will be seen spotting the white surface sometimes singly, sometimes in groups of eight.

After the asci have been discharged, numbers of ascospores remain crowded around the mouths of the perithecia; in a damp

* Barker. The Morphology and Development of the Ascocarp of Monascus. Ann. of Bot., 1903, p. 217.

J. S. Bayliss Elliott del.

atmosphere these germinate and the stroma becomes studded over with little white tufts of mycelium which appear to issue from the mouths of the perithecia: and in some instances this is the case for stromata which had apparently discharged all their ascospores were examined and some of the few ascospores which had not been set free had germinated inside the perithecia. These tufts in the course of a few days become covered with conidia; on detached ripe fruit bodies kept in a moist atmosphere under a bell jar these tufts always appear but in the open are rarely seen except on logs lying in very sheltered places.

In conclusion I wish to express my great indebtedness to the late Professor G. S. West for the loan of books of reference.

DESCRIPTION OF PLATE VI

Fig.

31. Conidia and conidiophores from bark of ash log infected with *Daldinia concentrica*.
32. Small portion of ascospore tendril which has exuded from a perithecium.
33. Conidiophores and conidia from hanging drop culture of ascospores.
34. Section through a few exterior zones of a perithecial stroma, showing an outer layer of distinctly formed perithecia, and inner zones where previously formed perithecia are seen in various stages of distinctness.
35. Conidiophores bearing conidia growing on bark.
36. Perithecial stromata appearing on a patch of conidiophores.
37. Tendrils of ascospores arising from the mouths of perithecia which were rapidly discharging their contents in a still atmosphere.
38. Sections of very young perithecia.
39. Section of perithecium somewhat older.

SOME OBSERVATIONS ON ERYSIPHE POLYGONI DC.

By G. O. Searle, B.Sc., P.A.S.I.

(Bd. of Agric. Research Scholar, Botany School, Cambridge.)

The work described in this paper was carried out by the author during 1913–14 in the Mycological Department of the South-Eastern Agricultural College, Wye.

The war caused a cessation of the work in August 1914, and no opportunity of continuing the investigation or of publishing the results has occurred until now, except in the one instance given below. Though far from complete and though a considerable time has elapsed since they were undertaken, it was thought that these observations might contain sufficient points of interest to be worthy of publication.

My thanks are due to Mr E. S. Salmon for the many suggestions and great help he gave me.

The investigation, as originally conceived, fell under the following three heads:

(A) The Comparative Susceptibility of Varieties of Swedes and Turnips to the "Swede Mildew" (*Erysiphe Polygoni* DC.).

(B) The Specialisation of Parasitism within the Morphological Species *Erysiphe Polygoni* DC.

(C) The Method of Over-wintering of the "Swede Mildew" (*Erysiphe Polygoni* DC.).

(A) In the case of the first problem to be attacked, the result of the field trials for 1913 have already been published in full elsewhere (12), and will only be very briefly described here.

Samples of seed of thirty-three varieties of Swedes, forty-two varieties of Turnips and two varieties of Rape were obtained from five well-known seeds-merchants in England and Scotland.

These seeds were sown, on June 9th, 10th, and 12th, in small plots measuring ten links square, i.e. one-thousandth of an acre each, on old lucerne ley which had been ploughed and dunged but had received no artificials. The plots were cultivated and thinned in the usual way. On August 23rd the conidial stage of *Erysiphe Polygoni* was found on Swedes in a field situated at some distance from the plots, and on the 28th of August sufficient material was collected from this field to carry out the infection of the plots in the following manner.

A number of the infected leaves were picked and placed in a warm moist atmosphere for twenty-four hours to encourage the formation of conidia. The leaves were then washed in large cans of water until it became quite milky from the number of conidia contained. This spore suspension was then sprayed through a fine rose, as evenly as possible, over the seventy-seven plots. Previous to spraying a very careful examination was made but no mildew could be found on any plot. The weather was dull but no rain fell for three or four days after inoculation.

Examined on Sept. 2nd, a few minute patches of mildew were found on nearly every plot. From Sept. 6th to Oct. 9th the severity of attack was classified once a week in the following manner: Marks were assigned each week to each plot, these marks varying from 0–10 according to the severity of the attack; the plots marked 0 were those on which no trace of mildew could be found, and so on proportionately up to 10 assigned to the plots most severely attacked, and on which not a single leaf could be found free from mildew. By Oct. 9th the attack seemed to have attained its maximum severity, and on Nov. 3rd all the roots were pulled, topped, cleaned and weighed. On an average the plots contained fifty roots each.

The following are the salient points of the results.

No variety of Swede, Turnip or Rape was found to be wholly immune.

Only two varieties, both Turnips, were marked as low as "1" when the weekly readings were averaged at the end of the trials.

The Swedes were attacked more severely than the Turnips; the Rape came approximately midway between the two in the severity of the attack. The Turnips were attacked most on the underside of the leaf.

It was reported by nurserymen that, in the North of England at any rate, Bronze Top Swedes were more liable to mildew than Purple or Green Top varieties and that Purple Top Yellow is more susceptible than Green Top Yellow; this was not confirmed by the trial, a Green Top Swede being one of those averaging $9\frac{1}{6}$, whilst another Green Top averaged only $2\frac{1}{3}$, two Bronze Top varieties averaged 8.

The plots being so small, too great an experimental error was introduced to allow any reliable comparison of yields with severity of mildew attack, though it is of interest to note that the two highest yields, each 106 lbs. per plot, averaged in marking 2 in one case and $2\frac{2}{3}$ in the other; these were both Turnips.

In 1914 one hundred and four varieties were obtained, including all those previously tested, but owing to the outbreak of war the trials came to an end.

My thanks are due to the firms of Messrs Sutton & Sons, Austin & McAslan, Drummond, Little & Ballantyne and Carter for kindly providing me with the seed free.

(B) As has been conclusively proved by the work of several investigators including Neger (2), Marchal (3), Salmon (4, 5, 6) and Reed(11), many species of Erysiphaceae show that specialisation of parasitism which results in the evolution of "biologic forms," forms morphologically identical but totally distinct in their infection powers, being, in most cases that have been investigated, confined to a single species or to a few closely related species of host plants and seldom having powers of infection outside the genus.

The experiments described in this paper were undertaken with a view to extending the knowledge of this specialisation as far as the morphological species *Erysiphe Polygoni* was concerned, more especially in the case of the conidial form of that species found on cultivated Brassicae.

It may be stated here that throughout the whole investigation the perithecial stage was never found on any Brassicae, so that the oidium used in inoculations was only identified as *Erysiphe Polygoni* by its host, no other species of Erysiphaceae having, so far as I know, been reported on the genus *Brassica*.

The method of inoculation was the usual one of drawing the edge of a sterile scalpel through the patch of mildew from which the conidia were to be taken and then, after placing a drop of water on the leaf to be inoculated, drawing the edge of the scalpel through the drop thus leaving the conidia floating in it. The whole plant was then kept under a bell-jar for twenty-four hours after which the bell-jar was removed completely or raised enough for ventilation.

There was always a chance of a certain amount of natural infection taking place especially towards the end of September, although all the plants used were kept in a separate greenhouse as soon as inoculated, so only those results were accepted as positive where infection occurred at the exact spot inoculated and the remainder of the leaf was entirely free from mildew; if the remainder of the leaf showed any mildew the experiment was discarded, whether there was infection at the inoculated spot or not.

All the plants used were grown from seed in pots in a greenhouse. In each case the first sign of infection (when this occurred), was noticeable in about six days, when a small powdery patch of mycelium, visible to the naked eye, appeared.

A few general observations will first be given.

The late summer and early autumn of 1913 were characterised

by a particular abundance of mildew in the Wye district, but little was noticed earlier in the year. A very careful search for the conidial stage of *Erysiphe Polygoni* on some of its commoner hosts was made during July and August, but it was not found out of doors until August 19th on *Polygonum aviculare* and August 23rd on Swedes. On the other hand it appeared spontaneously in the greenhouse on Swedes on July 23rd and on *Polygonum aviculare* on August 2nd.

This same phenomenon was noted in other cases, the conidial stage on Turnip, Rape, *Sonchus arvensis*, *Linum usitatissimum*, *Pisum sativum*, *Trifolium pratense*, *Onobrychis sativa*, *Trifolium dubium*, *T. hybridum*, *T. repens*, *Capsella Bursa-pastoris*, and *Brassica Sinapis*, all appeared in the greenhouse at least a fortnight before they could be found out of doors even though careful daily search was made; this will be referred to later.

The first series of inoculations were with the conidia from the Swede, with a view to investigating how far the oidium on Swede was specialised in relation to other hosts of *Erysiphe Polygoni*, especially other cultivated Brassicae.

In the following tables the sign + signifies a full infection powdery with conidia and fully visible to the naked eye; the sign o signifies no visible infection; the sign ? signifies that a "subinfection" resulted, consisting of a few hyphae and a very few conidia visible only with a lens. The significance of subinfections will be discussed later. The sign – signifies that the experiment was discarded owing to infection appearing naturally on other spots than those inoculated.

TABLE I.

Inoculations with conidia from Swede.

Hosts inoculated	No. of inoculations	No. of infections
Swede	8	+ 8
Swede (cotyledons)	41	+37
Swede (first leaves)	6	+ 6
Turnip	13	+10
Turnip (cotyledons)	9	—
Cabbage	32	? 31
Kohl-rabi	10	? 7
Rape	26	+23
Broccoli	10	? 9
Kale (Thousand Head) ...	33	? 28
Charlock (*B. Sinapis*)		
(*a*) Under cloches out of doors	10	o
(*b*) In greenhouse	18	—
(*c*) In greenhouse	10	+5 ? 5
Geranium molle	6	o
Ranunculus arvensis	7	o
Polygonum aviculare	7	o
Trifolium pratense	6	o
Cnicus lanceolatus	3	o

The above results are interesting in that they indicate that the "biologic form" of *Erysiphe Polygoni* on the Swede is able to cause a full infection on the Turnip and Rape, all three being cultivated forms of the same aggregate species *Brassica campestris* Linn., whilst it is only capable of forming a "subinfection" on Cabbage, Kohl-rabi, Broccoli and Kale, which are cultivated forms of the aggregate species *Brassica oleracea* Linn. Further, that in the case of Charlock (*B. Sinapis*) the position is very obscure as in five instances full infections resulted, in five other instances "subinfections" only appeared and in a further ten cases no infection at all took place which seems to indicate, either that there was some physiological difference between the Charlock plants used—in one case the plants used were those raised in the greenhouse from seed and in the other were plants found growing wild and simply covered with a cloche—or that some temperature or moisture factor enters into the problem.

Further it will be seen that in no case did an infection result on any of the hosts used belonging to other families.

Though no opportunity occurred of repeating and confirming these series the following year, the results indicate that the "biologic form" on Swede is confined to the aggregate species *Brassica campestris* with powers of slight infection on *B. oleracea* and probably under certain conditions on *B. Sinapis*.

TABLE II.

Inoculations with conidia from *Polygonum aviculare*.

Host inoculated	No. of inoculations	No. of infections
Polygonum aviculare	8	+6
Swede	22	0
Swede (cotyledons)	8	0
Trifolium pratense	3	0
Swede (first leaves)	3	0
Turnip (cotyledons)	15	0

These results go to confirm the indications of Table I that the forms of *Erysiphe Polygoni* on *Polygonum aviculare* and *Brassica campestris* are distinct "biologic forms."

TABLE III.

Inoculations with conidia from *Trifolium pratense*.

Hosts inoculated	No. of inoculations	No. of infections
Trifolium pratense	4	+4
T. hybridum	3	0
T. repens	6	0
Vicia Faba	8	0
Onobrychis sativa	4	0

This table indicates that the form of *Erysiphe Polygoni* on *Trifolium pratense* is specialised on that species and is unable to infect other species of the same genus or other genera of the same family, thus, as far as the experiment was carried, confirming the more extensive series carried out with the oidium on *T. pratense* by Salmon (4).

Two further experiments with clovers were tried, in one of which conidia from *Trifolium minus* were found unable to infect *T. pratense* or *Onobrychis sativa*, and in the other conidia from *Trifolium hybridum* were found unable to infect *T. repens*.

A short series was then tried with the form on *Pisum sativum*.

TABLE IV.

Inoculations with conidia from *Pisum sativum*.

Hosts inoculated	No. of inoculations	No. of infections
Pisum sativum	5	—
,, ,, ...	15	+10
Onobrychis sativa	10	0
Vicia Faba	24	0
Trifolium pratense	4	0

This table confirms the fact, already noted by Salmon, that the oidium on *Pisum sativum* should rank as a "biologic form."

A single experiment with the oidium on *Capsella Bursa-pastoris* showed that the conidia, though able to infect fully *Capsella Bursa-pastoris* (six inoculations), were unable to infect the Swede (six inoculations).

In confirmation of Table I a further experiment with the conidia from Rape was tried; in this case eight inoculations on Turnip caused six full infections, but ten inoculations on Kohl-rabi produced no infections, whereas one would have expected that "subinfections" would have resulted.

All the above inoculations were carried out between July 29th and Sept. 26th after which date the spread of natural infection in the greenhouse was so general that further trials were entirely vitiated.

A number of series was then commenced in the laboratory employing excised leaves placed on moist filter paper in Petri dishes, and pieces of stem placed in larger dishes. These experiments gave some interesting results especially in their bearing on the growth of species of the Erysiphaceae on internal tissues of plants in contradistinction to their usual ectoparasitic existence. This phenomenon had already been noted by Salmon (10) when working with *Erysiphe graminis*.

Before describing these series it will be necessary to deal

briefly with the question of "subinfections." Salmon (4) (pp. 270–271) in his work on *Erysiphe graminis* and the Bromes found that in some inoculations the only result was a few minute flecks of mycelium and a few scattered conidiophores; in some cases these minute infections disappeared within a few days and in others small flecks of mycelium persisted. He came to the conclusion that a faint infection does actually occur and that the flecks of mycelium and few conidiophores are not merely the production of a conidium germinating and living independently for a short time. He called these slight infections "subinfections."

In the work described here the phenomenon of "subinfections" was encountered early. As will be seen from Table I above, inoculation of conidia from Swede on to cultivated species of *Brassica oleracea* invariably produced "subinfections" only. However in these particular cases of "subinfections" there is another detail to be taken into account and that is the distinct discolouration of the epidermis of the host which takes place. Superficially the epidermis at a point where a "subinfection" is present shows a series of minute black spots giving the appearance of local death of the cells. In section it was found that in some cases only an epidermal cell or a small group of cells were affected, the walls being very dark brown and the cells being filled with a dark brown disorganised content so dense that it was impossible to determine if normal haustoria had been formed or not; in other cases the discolouration radiated into the subepidermal cells changing the cell walls to a dark brown colour and sometimes the cell content also.

The discolouration of the epidermis by species of Erysiphaceae has been noted by several investigators and was discussed by Grant Smith (1), but the discolouration noted by him did not seem to be of such an extreme nature as that under consideration now, as Grant Smith says it was not noticeable in sections when cut and stained and seemingly normal haustoria were visible. In fact the discolouration was so distinct in the present instance that by its means the phenomenon of "subinfection" was later discovered in the field. Salmon ((4) p. 270) says, "It may be that, in some cases under certain favourable conditions the fungus could exist permanently and increase on such a host plant." That this is the case at any rate with "subinfections" on cultivated *Brassica oleracea* is confirmed by the following field observations.

Oct. 1913. After long search a Rape plant severely infected with the oidium of *Erysiphe Polygoni* was discovered in the centre of a large field of Kohl-rabi. An investigation of the Kohl-rabi plants showed that all those plants within a few yards

of the Rape plant had their leaves and stems covered with minute black spots, which, examined microscopically, were found to be wherever minute flecks of mycelium were present. This mycelium was quite easy to trace to the large numbers of conidia to be distinctly seen scattered over the surface. The area of infection was quite local as Kohl-rabi plants at more than five to six yards from the Rape plant only showed very few "subinfections." Under the circumstances it seemed to be a permissible conclusion to take the Rape plant as the centre of infection.

A few days later the same effect was seen in the case of Cabbages, again round a chance plant of Rape growing amongst them. The appearance in this case was exactly similar to the "subinfection" on the Kohl-rabi plants and again the Cabbages further away from the Rape plant were unaffected.

Then the phenomenon was noted on Brussels Sprouts; in this case they were some plants growing near the Swede plots used in the first investigation (A). Here the "subinfections" were much more distinct and generally, though not entirely, confined to the petioles; they showed up distinctly to the naked eye as patches, $\frac{1}{8}$ to $\frac{1}{2}$ inch across, of minute black spots, the patches being rather symmetrical in shape as though the overlying mycelium was formed by the growth from a single conidium. In every case a few conidiophores and conidia could be seen.

The last case noted was on the cultivated Brassica known as Marrow-stemmed Kale. In this case the appearance was very distinctive as under the microscope the black spots were found to follow the course of the hyphae at regular intervals giving a dendritic appearance and making it look almost certain that the spots were formed wherever a haustorium had entered or endeavoured to enter the epidermal cells.

Nov. 27th. The weather had been exceptionally warm and moist. "Subinfections" on Marrow-stemmed Kale became much more vigorous and such a large number of conidia had been formed that the characteristic discolouration could hardly be seen. However the mycelium had not spread beyond its former limits. The same happened to a slighter extent on the Brussels Sprouts.

Dec. 6th. Weather decidedly colder. Some "subinfections" on Marrow-stemmed Kale had spread $\frac{1}{4}$ inch beyond the discoloured patch without further discolouration being formed, but very few conidia were to be found on the new mycelium. Some "subinfections" on Brussels Sprouts had now developed into full infections, in this case also without further discolouration.

Dec. 10th. "Subinfections" on Marrow-stemmed Kale were observed on specimens exhibited at Messrs Garton's stand at

Smithfield Show. On enquiry it was found that the Kale had been grown in Norfolk.

Dec. 15th. After several hard frosts it was noted that the "subinfections" were still present on Marrow-stemmed Kale but only very few conidia could be seen. The infections on Brussels Sprouts were quite vigorous with a number of young conidiophores and conidia. On Rape fresh looking powdery patches of mildew were numerous. On Swede it was now difficult to find any mildew except on the lower surface of the leaves.

Dec. 17th. A number of fresh spots of mildew were found on the under surface of Swede leaves, all of them were quite powdery with conidia. "Subinfections" were very numerous on Thousand Head Kale.

Jan. 6th. During the previous fortnight the temperature dropped at times to 17° F. and there had been several inches of snow. "Subinfections" on Thousand Head Kale were found to be in a quite healthy condition. Small patches of mycelium were found on Swedes but without conidia.

Jan. 13th. Thousand Head Kale leaves, covered with snow, were collected, and under the snow were found seemingly healthy patches of mycelium. These leaves were brought into a warm laboratory and in a few days developed a large number of conidia on the patches of mycelium.

Jan. 26th. Temperature during previous week at times dropped to 12° F.

March 7th. Thousand Head Kale observed with small "subinfections" still alive and a few conidia.

Early May. "Subinfections" on Thousand Head Kale and Marrow-stemmed Kale in the same dormant condition.

Mid-May. "Subinfections" on a Thousand Head Kale plant commenced to spread first on to the lower leaves and then on to the new upper leaves. Infections then appeared on a Rape plant and a Swede plant standing next to the Kale.

It would appear therefore from the above observations that an actual infection of the plant does occur in the case of "subinfections" and that it is quite possible in Nature for a "subinfection" to continue existence as such and later grow out into a full infection.

As these "subinfections" have been found to occur quite naturally in the field, it shows that they are not merely a phenomenon caused by carrying out inoculations under cultural conditions, nor do they depend on a large number of conidia being sown on one spot as suggested by Salmon (7), though that may be the cause in certain cases, noted with artificial inoculations.

It would seem possible that "subinfections" are the pre-

liminary stages of the spread of the fungus on to a new host, especially since, as it is shown later, the conidia formed on the "subinfection" are fully viable.

The first series undertaken in the laboratory was one using conidia from the Swede and Rape. Inoculations were performed on leaves in water under a bell-jar.

TABLE V.

Conidia from Swede.

Date	Host used	No. of inoculations	No. of infections	Remarks
Nov. 21	Swede ...	4	+4	
,,	Turnip ...	2	+2	
,,	Rape ...	2	+2	
,,	Kohl-rabi	2	—	Leaf died
Nov. 29	Swede ...	4	+4	
,,	Kohl-rabi	8	? 7	With discolouration

Conidia from Rape.

Nov. 21	Rape ...	2	+2	
,,	Kohl-rabi	2	? 2	

This table shows the typical results already noted in Table I.

Two experiments with conidia from "subinfections" on Marrow-stemmed Kale were then tried; four inoculations on to Kohl-rabi leaves gave four "subinfections" but with no visible discolouration of the epidermis; four inoculations on to Swede leaves gave four full infections. These two experiments prove the viability of conidia formed on "subinfections."

It was now decided to carry out several series to test how far the fungus could adapt itself to continued life on the internal tissues of various hosts and to observe if any differences in infective power took place under such conditions. These series were carried out in large Petri dishes lined with moist filter paper, and kept at a temperature varying between 50–60° F.

The following abbreviations are used:

"Cut M.S.K." = A piece of stem of Marrow-stemmed Kale approx. 3 inches long and $1\frac{1}{2}$ inches diam. cut in half lengthwise, so that it is about $\frac{3}{4}$ inch thick and then a sloping cut made in the upper uninjured surface to remove a wedge-shaped piece of tissue, leaving the internal tissue exposed to about $\frac{1}{8}$ inch deep. Conidia were then sown on the internal surface thus exposed. This was found to be a convenient size to use in large Petri dishes and kept fresh a long time.

"Cut ... petiole" = A piece of petiole, of host used, about $2\frac{1}{2}$ inches long with a wedge-shaped piece cut out leaving internal tissue exposed to $\frac{1}{8}$ inch deep.

SERIES A. Commenced Dec. 9th. Conidia from sources shown.

One inoculation in each experiment.

No. of Expt.	Source of conidia	Host used	Result	Remarks
A 1.	Swede ...	Inner surface of $\frac{1}{16}$" thick strip of M.S.K. stem	Full infection	Grew very slowly at first only a few hyphae by Dec. 17. Full inf. Jan. 6th
A 2.	Brussels Sprout (subinfection)	,, ,,	Full infection	,, ,,
A 3.	Swede ...	Outer surface ditto.	—	Overrun by mould
A 4.	Brussels Sprout	,, ,,	—	Conidia germinated but overrun with mould
A 5.	Swede ...	,, ,,	Full infection	Strong mycelium and many conidia by Dec. 17th
A 6.	Brussels Sprout	,, ,,	Full infection	Strong mycelium by Dec. 17th
A 7.	Swede ...	"Cut M.S.K."	Full infection	Both showed strong mycelium and many conidia Dec. 15th. Both showed a discolouration of the host cells
A 8.	Brussels Sprout	,, ,,	Full infection	
A 9.	Swede ...	B. Sprout petiole epidermis removed	—	Slight mycelium Dec. 17th then died out
A 10.	Brussels Sprout	,, ,,	Full infection	
A 11.	Swede ...	M.S.K. petiole, epidermis removed	Full infection	Strong mycelium with many conidia by Dec. 15th. Later spread to uninjured surface where it discoloured the cells
A 12.	Brussels Sprout	,, ,,	Full infection	
A 13.	Swede ...	"Cut M.S.K." $\frac{1}{32}$ inch deep	—	Strong mycelium and many conidia Dec. 17th but died by Jan. 6th
A 14.	Brussels Sprout	,, ,,	—	Very weak mycelium Dec. 17th then died out
A 15.	Rape ...	"Cut M.S.K. petiole"	Full infection	Strong growth with conidia Dec. 17th. Later spread to and discoloured the cells of uninjured surface
A 16.	Swede ...	B. Sprout petiole small piece of epidermis removed	Full infection	Spread without discolouration
A 17.	Brussels Sprout	,, ,,	Full infection	Spread on to uninjured surface without discolouration
A 18.	Swede ...	"Cut B. Sprout petiole"	Full infection	Spread without discolouration to uninjured surface

SERIES A. Commenced Dec. 9th. Conidia from sources shown (contd.)

One inoculation in each experiment.

No. of Expt.	Source of conidia	Host used	Result	Remarks
A 19.	Swede ...	Uninjured surface M.S.K. stem	Full infection	
A 20.	Swede ...	,, ,,	—	Few hyphae formed then died out
A 21.	Rape ...	,, ,,	0	
A 22.	Brussels Sprout	,, ,,	0	
A 23.	Brussels Sprout	,, ,,	—	Few hyphae formed then died out

The above results show that the "biologic form" of *Erysiphe Polygoni* on cultivated Brassicae is able to live and produce conidia when sown on the internal tissue of its host instead of the epidermis. Further that when the form on varieties of *Brassica campestris* was sown on varieties of *B. oleracea*, which had been injured by cutting, full infections resulted instead of the usual "subinfections." It is also of interest to note that in some cases (e.g. A 7 and A 15) the cells of the host underwent the typical discolouration even though a full infection finally resulted; this discolouration was more notable however when the mycelium spread to the uninjured epidermal cells.

In view of the difficulty of keeping cultures of species of Erysiphe for any length of time owing to its obligate parasitism, it is worthy of note how useful the cut stem of Marrow-stemmed Kale was found to be. This material kept remarkably fresh in a large Petri dish on wet filter paper and, on the whole, remarkably free from saprophytic fungi. As an instance it may be noted that a piece of cut Marrow-stemmed Kale stem after fifty-nine days in a Petri dish showed a perfectly healthy patch of new mycelium with numerous chains of ripe conidia.

By carrying out the inoculations in December, taking pieces of Marrow-stemmed Kale from plants distant from those carrying subinfections, and by sterilising Petri dishes, it was possible to reduce the chances of natural infection to a negligible quantity, especially as the inoculations were carried out on freshly cut surfaces.

The second series (B) was carried out in extension of the first and also to test the viability of the conidia produced in series A.

This series shows the full viability of conidia produced by mycelium on cut surfaces; also that the distinctive discolouration cannot be entirely correlated with the source of the conidia in the first generation.

As in Series A the inoculations on uninjured Marrow-stemmed Kale seemed to fail under cultural conditions and Brussels

Sprout petiole was found much less satisfactory to keep in Petri dishes than Marrow-stemmed Kale, since it very quickly became attacked by various bacteria and moulds and rotted.

SERIES B. Started Dec. 20th. Conidia from sources shown. One inoculation in each case.

No. of Expt.	Source of conidia	Host used	Result	Remarks
B 1.	A 7	"Cut M.S.K."	Nearly full infection	A number of conidia. Medium discolouration
B 2.	A 12	,, ,,	Full infection	Powdery patches of conidia. Very little discolouration
B 3.	A 11	,, ,,	Full infection	Powdery patches of conidia. Great discolouration
B 4.	A 8	,, ,,	Full infection	Powdery patches just visible. Very strong discolouration
B 5.	Swede	,, ,,	Slight infection	Healthy mycelium. Few conidia. Slight discolouration
B 6.	Marrow-stemmed Kale	,, ,,	Full infection	Powdery patches of conidia. Very slight discolouration
B 7.	,, ,,	M.S.K. stem uninjured surface	0	
B 8.	Brussels Sprout	,, ,,	0	
B 9.	Marrow-stemmed Kale	"Cut B. Sprout petiole"	—	
B 10.	Swede ...	,, ,,	—	Slight mycelium and young conidia. Then rotted
B 11.	Brussels Sprout	,, ,,	0	
B 12.	Brussels Sprout	B. Sprout petiole uninjured surface	0	

Series C was undertaken to test the viability of the conidia when carried to the third generation on cut surfaces.

SERIES C. Started Jan. 22nd. Conidia from sources shown. One inoculation in each case.

No. of Expt.	Source of conidia	Host used	Result	Remarks
C 1.	B 6	"Cut M.S.K."	Full infection	Large powdery patches. Very numerous conidia. Strong discolouration
C 2.	B 1	,, ,,	Slight infection	Few conidia. Wound being overgrown by callus
C 3.	B 2	,, ,,	Full infection	
C 4.	Thousand Head Kale	,, ,,	Full infection	Powdery patches. Very numerous conidia. Slight discolouration

The next series (D) carried on the fungus to the fourth generation on cut surfaces.

SERIES D. Started Feb. 12th. Conidia from sources shown.

One inoculation in each case.

No. of Expt.	Source of conidia	Host used	Result	Remarks
D 1.	C 1	"Cut M.S.K."	Full infection	Patches powdery with conidia. Very distinct discolouration
D 2.	C 3	,, ,,	Medium infection	Fairly numerous conidia. Very distinct discolouration
D 3.	C 4	,, ,,	Medium infection	,, ,,

An attempt was made on March 6th to carry on to the fifth generation on cut Marrow-stemmed Kale stem but the Kale was by this time too old and all the pieces used soon died and rotted.

However the above series show that it is possible to carry on cultures of an Erysiphe on the exposed internal tissues of its host over four generations in three months.

An experiment was then tried to demonstrate whether infection would take place on the internal tissue of the swollen hypocotyl ("root") of the Swede in the same way as on the stem of the Marrow-stemmed Kale.

SERIES 1 S 1. Started Jan. 28th. Conidia from sources shown.

One inoculation in each case.

No. of Expt.	Source of conidia	Host used	Result	Remarks
1 S 1.	Swede	"Cut surface Swede root"	Full infection	Large number young conidia Feb. 12th
1 S 2.	B 3	,, ,,	,, ,,	One or two patches powdery with conidia Feb. 12th
1 S 3.	B 6	,, ,,	,, ,,	,, ,,
1 S 4.	Thousand Head Kale (subinfection)	,, ,,	,, ,,	Large patch powdery with conidia Feb. 12th
1 S 5.	Marrow-stemmed Kale (subinfection)	,, ,,	,, ,,	Large patch powdery with conidia Feb. 12th

This series shows that infection took place quite successfully on the internal tissue of Swede "root." In no case was there any discolouration shown.

An attempt was made to carry this series on to another

generation but in each case the Swede rotted before any result could be obtained.

The internal tissue of an epicotyl, in this case the swollen epicotyl of the Kohl-rabi, was used in the next series.

SERIES 2 K. Started Feb. 12th. Conidia from sources shown.

One inoculation in each case.

No. of Expt.	Source of conidia	Host used	Results	Remarks
2 K 1.	Rape	"Cut surface Kohl-rabi epicotyl"	Slight infection	A few young conidia. Slight discolouration
2 K 2.	Brussels Sprout	,, ,,	0	—
2 K 3.	Swede	,, ,,	Medium infection	Fairly numerous conidia. Very slight discolouration
2 K 4.	1 S 5	,, ,,	0	—
2 K 5.	C 1	,, ,,	Medium infection	,, ,,

The last two series certainly indicate that, however far species of Erysiphe may be specialised as to their hosts, the infection powers are always constant within that host whatever part is used for inoculation. This is specially noticeable if one traces the genealogy of 2 K 5, which, starting as conidia from a "subinfection" on Marrow-stemmed Kale, passed two successive generations on the internal tissues of Marrow-stemmed Kale and finally produced conidia again on the internal tissue of the epicotyl of Kohl-rabi; or the example of 1 S 2, which started as conidia from a full infection on the uninjured epidermis of a Swede leaf, spent one generation on the outermost cells of the cortex of the Marrow-stemmed Kale stem, one generation on the innermost layers of cortex and vascular tissues of the same, and finally successfully produced a full infection on the internal tissue of a Swede hypocotyl. In the latter case conidia from 1 S 2 were, on Feb. 12th, inoculated on to "cut M.S.K." again and by Feb. 23rd gave a slight infection showing a few conidia and distinct discolouration.

The last series to be undertaken was to demonstrate the infection powers of conidia from "subinfections" when inoculated on to the uninjured surface of various hosts usually only bearing "subinfections," i.e. cultivated varieties of *Brassica oleracea*. A few inoculations on to varieties of *B. campestris* were included as controls.

In each case uninjured leaves in water under bell-jars were used as hosts.

The signs used have the following significance: — = Experi-

ment discarded, usually through death of leaf; o = No infection; ? = Subinfection; :– = Medium infection, rather more than subinfection; + = Full infection.

Table VI.

Conidia from sources shown.

Date	Source of conidia	Host used	No. of inoculations		Result
Jan. 20	B. Sprout ?	M. S. Kale	4	:–4	Distinct discolouration
,,	,, ,,	Thousand Head Kale	4	+4	Very slight discolouration
,,	,, ,,	B. Sprout	4	+4	
,,	Marrow-stemmed Kale ?	B. Sprout	4	+4	
,,	,, ,,	Thousand Head Kale	4	? 2	+2
,,	,, ,,	M. S. Kale	4	? 4	Slight discolouration
,,	,, ,,	Swede	4	—	Leaf died
,,	A 5	M. S. Kale	4	? 4	Leaf died early
Jan. 26	Marrow-stemmed Kale ?	Turnip	4	+4	
,,	,, ,,	Rape	4	+4	
,,	,, ,,	M. S. Kale	4	? 4	
,,	B. Sprout ?	Turnip	4	+4	
,,	,, ,,	B. Sprout	4	:–2 +2	Distinct discolouration
,,	Thousand Head Kale ?	B. Sprout	4	:–4	
,,	,, ,,	M. S. Kale	4	? 4	Very slight
,,	,, ,,	Thousand Head Kale	4	? 4	
Feb. 26	B. Sprout?	B. Sprout	2	:–2	Fair amount mycelium. Few conidia. Some discolouration
,,	,, ,,	M. S. Kale	2	:–2	Fair amount mycelium. Few conidia. Distinct discolouration
,,	,, ,,	Thousand Head Kale	2	? 2	
,,	Marrow-stemmed Kale ?	B. Sprout	2	:–2	No discolouration
,,	,, ,,	M. S. Kale	2	:–2	Few conidia. Some discolouration
,,	,, ,,	Thousand Head Kale	2	? 2	Some discolouration
,,	Swede +	Rape	4	+4	Large quantity mycelium. Few conidia
,,	,, ,,	Turnip	4	+3	One leaf died

These results show that, under cultural conditions,

1. Conidia from "subinfections" on varieties of *Brassica oleracea* are quite capable of giving full infections on varieties of *B. campestris*.

2. Conidia from "subinfections" on varieties of *Brassica oleracea* when sown on *B. oleracea* sometimes give full infections, though more usually they give "subinfections" or medium infections which cannot quite be classed as full infections.

It is hoped to be able to carry out soon a much longer series of similar inoculations, including also hybrids between *Brassica campestris* and *B. oleracea*, so that definite conclusions may be drawn as to the relative infection powers of conidia taken from "subinfections" on *B. oleracea* and full infections on *B. campestris*.

(C) In the case of *Erysiphe Polygoni* on cultivated Brassicae the method of over-wintering must be restricted to one or more of the following:

1. Perithecia.
2. Persistent mycelium.
3. Re-infection in the spring direct from other hosts of *Erysiphe Polygoni*, or by spores from "bridging species."
4. "Subinfections" within the genus Brassica.

The perithecial stage of the fungus is very seldom found on the cultivated Brassicae. In fact the writer, though making constant search, failed to discover perithecia on these hosts during the whole course of the investigation. Of course this does not imply that they never occur, but they are of such rare occurrence that alternative No. 1 above can be ruled out as a negligible method for the fungus of over-wintering.

In face of the experiments described in this paper and the large number of other experiments which have been carried out with other species of Erysiphe, all of which go to prove the extreme specialisation of parasitism of this genus of fungi, it seems permissible to lay down definitely that alternative No. 3 is also highly improbable; even though one takes into consideration the possibility of "biologic forms" breaking down, either under certain climatic conditions which, as far as the writer knows, has not been shown to occur by any investigator, or of their breaking down by reason of various injuries to the host, as has been demonstrated by Salmon (8, 9).

Even in the case of such a very closely related species as *Brassica Sinapis* there is a certain amount of doubt as to the free transference of the mildew to the species *B. campestris* and *B. oleracea* though it is possible that Charlock does help in a small degree in the reinfection of varieties of the cultivated

Brassicae in spring, though in this case again perithecia are equally rare.

It would therefore seem more probable from the experiments and field observations already described (although they are far from complete) that alternatives No. 2 and No. 4 are the most likely methods by which the mildew exists over the winter.

One or more of the cultivated Brassicae are always to be found in leaf at all seasons of the year on a farm, and above it has been shown that the conidial stage of the mildew was successfully kept under observation out-of-doors on one or other cultivated Brassica during the autumn, winter and round to the middle of the following May, and that, even after heavy frosts, viable conidia were formed.

As Swedes and Turnips are not often present on the farm in the spring, it is probable that infection is carried on mainly by "subinfections" on varieties of *Brassica oleracea* (which are generally to be found throughout the early spring in the form of Cabbage or Kale), aided by persistent mycelium on "volunteer" plants of Swede, Turnip or Rape.

It may be argued that it is difficult to understand why, if the mildew is able to attack Swedes and Turnips in the cotyledon stage as has been shown to be the case, it is not usual to find a bad attack before July when the plants are well advanced, but it would seem that this depends largely on climatic conditions, which have not yet been fully investigated. It will be remembered that the "subinfections" on Thousand Head Kale did not develop into distinct visible full infections until the middle of May and it is quite possible that infection may take place but the mildew remain in an undeveloped form invisible to the naked eye, until climatic conditions are suitable. Such an explanation would account for the fact, mentioned early in this paper, that numerous forms of *Erysiphe Polygoni* appeared spontaneously in the greenhouse some time before they could be found out-of-doors, presumably because the temperature of the greenhouse was more suitable for the full development of the fungus.

Summary.

1. In field trials in 1913 no variety, out of seventy-seven varieties of Swedes, Turnips and Rape, was found to be immune to *Erysiphe Polygoni* DC. Swedes were attacked more severely than Turnips.

2. In inoculation experiments with cultivated varieties of *Brassica campestris* and *B. oleracea*, the form of *Erysiphe Polygoni* infecting these varieties was found to be a "biologic form" with this additional distinction that inoculations from

B. campestris to *B. oleracea* invariably gave "subinfections" as the result.

3. "Biologic forms" on *Polygonum aviculare, Trifolium pratense* and *Pisum sativum* were indicated.

4. "Subinfections" on varieties of *B. oleracea* were observed in the field and found to exist over the winter and in some cases grow into full infections.

5. Inoculations were undertaken in the laboratory and were successful both on uninjured leaves and on the internal tissues of stems; these latter were carried as far as the fourth generation.

6. Inoculations with conidia from "subinfections" were carried out and the conidia shown to be viable.

7. It is suggested that the most probable method of overwintering of the "biologic form" of *Erysiphe Polygoni* on the cultivated Brassicae is by means of "subinfections" on varieties of *B. oleracea* aided by persistent mycelium on varieties of *B. campestris.*

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UPON THE VISIBILITY OF SPORE DISSEMINATION IN FOMES PINICOLA (SWARTZ.) FR.

By R. E. Stone, Ph.D.

(Department of Botany, Ontario Agricultural College.)

The larger fungi liberate millions of spores and yet the dissemination of the spores has not often been directly seen. Buller* has observed this phenomenon probably in more species than any one else, and he has devised a number of methods for detecting it. With the naked eye he saw spore clouds leaving the under surface of a fruit-body of *Polyporus squamosus* for thirteen days in succession†. The following observations were made by myself upon a fruit-body of *Fomes pinicola* in a wood near Guelph, Ontario, and I am recording them at Professor Buller's suggestion.

In May, 1917, I was collecting fungi in a dense poplar and white spruce swamp. Having become tired I sat down on a fence a short distance from a large stump from which was protruding a fruit-body of *Fomes pinicola*. The fungus was directly between myself and the sun and it was brightly illuminated by rays of light penetrating through the dense foliage. I distinctly saw clouds of spores streaming from the under side of the fruit-body and drifting away in the very slight air currents that were moving between the trees.

* A. H. R. Buller, Researches on Fungi. London, 1909, pp. 89–101, 133–147.
† *Ibid.* p. 90.

UPON THE AUDIBILITY OF SPORE DISCHARGE IN HELVELLA ELASTICA (BULL.).

By R. E. Stone, Ph.D.

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The forcible discharge of spores has been observed in a great many Ascomycetes. The spore-discharging organs or asci of these fungi are very minute. Hence it is that the sound which they emit when they explode has been heard only in the case of a few species with large fruit-bodies.

Buller* has confirmed the observations of Grove that the discharge of the sporangium in *Pilobolus* is accompanied by a distinct sound. De Bary† reports hearing a hissing sound accompanying the puffing of *Peziza acetabulum* and *Helvella crispa*, thus substantiating the earlier report of Desmazières. In this connection some observations of my own on the audibility of spore discharge in *Helvella elastica* may prove of interest.

In June, 1915, the Ascomycete *Helvella elastica* was very abundant in the neighbourhood of the Agricultural College at Guelph, Ontario. On June 21 I collected many fruit-bodies of this fungus and brought them into the laboratory where I left them in a closed basket. The next day, while I was identifying species in the laboratory, my attention was attracted by an intermittent hissing sound apparently coming from the direction of the basket containing the fungi. The basket was five to six feet away from me. The room was very quiet and the sound was quite distinct. My curiosity having been aroused, I took the trouble to locate the source of the sound. All sources were soon eliminated except the basket containing the Helvella. Upon lifting the cover of the basket I clearly saw a spore-puff and at the same time heard a distinct hiss, louder than any I had heard before. In the course of half an hour I observed at least six puffs; and each puff was accompanied by a distinct hiss. The more pronounced the puff, the more audible, the more distinct, and the more prolonged were the accompanying hissing sounds.

The above observations have convinced me that at least for some of the larger Ascomycetes there can be no doubt whatever that the discharge of the spores is audible.

In conclusion I wish to thank Professor Buller for suggesting that I should write this brief communication.

* A. H. R. Buller, Researches on Fungi. London, 1909, p. 259.

† De Bary, Comparative Morphology and Biology of the Fungi, etc. Oxford, 1887, p. 92.

PIMINA PARASITICA GROVE.

By A. Lorrain Smith, F.L.S.

This peculiar fungus which was discovered by Greenwood Pim growing on the hyphae of *Botrytis* sp. was described by Grove as gen. and nov. sp. in Journ. Bot. XXVI. p. 206, 1888. Pim himself published a photographic plate of the fungus with a description in the second number of the Trans. Brit. Mycol. Soc., Vol. I. p. 65, 1898. A microscopic preparation was placed in the herbarium of the British Museum.

In more recent years a fungus occurring among moulds on the cork of a bottle of preserved fruits has been described at length by P. Vuillemin as *Urophiala* gen. and nov. sp. (Bull. Soc. Sci. Nancy, Sér. 3, XI. p. 158 (pls. 4–5), 1910). The description and figures leave absolutely no doubt that he was dealing with the same genus if not the same species.

The genus is of particular interest as Vuillemin has given it an important place in his scheme of classification of the Hyphales or Hyphomycetes. In this scheme, he insists on the systematic importance of the insertion of the spore or conidium. He distinguishes four different types of insertion: the conidia may be borne (1) directly on the hyphae; (2) at the top of a conidiophore; (3) on a specialised cell or sterigma which he terms a phialide to distinguish it from the sterigma of the Basidiomycetes, or (4) on a phialide which rises from a specialised cell or prophialide. These he groups as four orders:

I. Sporotricheae: spores borne directly on the hyphae, ex. *Sporotrichum.*

II. Sporophoreae: spores borne directly on a sporophore, ex. *Acremonium.*

III. Phialideae: spores borne on a sterigma or phialide, ex. *Spicaria.*

IV. Prophialideae: phialide rising from a prophialide, ex. *Urophiala* (*Pimina*).

In the last order Vuillemin places three families each containing one genus, I. Urophialaceae, II. Coemansiaceae, III. Coronellaceae.

His descriptions of *Urophiala* are as follows:
Urophiala Vuill. nov. gen.

Mycelium creeping, subhyaline; fertile hyphae erect, dark-coloured septate, simple, always of three parts: (1) a continuous or uni-septate stalk; (2) the head (or prophialide) brown, incurved bearing three, rarely two, spore bearing phialides; (3) apical filaments faintly coloured. Phialides ventricose, the apex curved, beaked, soft, soon evanescent, rarely rigid. Conidia solitary, acrogenous, hyaline, round or oblong, smooth.

Urophiala mycophila nov. spec.

Mycelium effuse, creeping, ca. 1μ thick; fertile hyphae fuliginous, 20–34μ high; stalk 4–17 × 2·5–4μ; prophialide 9–11μ high, 4μ thick, to 7–7·5μ wide, with apical filament 6–8 × 1·75–2μ; phialide subhyaline, ascending, 4 × 3–3·5μ; conidia ovoid, 5–7 × 4–5μ.

On cork among Mucedineae. Cultivated in a test-tube on carrot. Beyond stating that the fungus grows in association with moulds, Vuillemin does not say that it is parasitic, and there is also no clear evidence that our British species is parasitic on the *Botrytis*. The microscopic preparation is somewhat imperfect, but the prophialides correspond exactly in form with the French specimens. *Pimina* is closely associated with *Botrytis* conidiophores and may be parasitic but it also grows outside the "host" filament. Vuillemin to whom the matter has been submitted recognises the generic resemblance of the plants but considers them specifically distinct as Grove's plant is on the whole larger. It seems impossible to be absolutely sure until fresh specimens are found. Vuillemin is of opinion that Grove's genus should rank as a *nomen nudum* on account of the very imperfect description which applies more nearly to *Urobasidium*.

If Vuillemin's contention be accepted, the British species would become *Urophiala parasitica*, but if as unfortunately seems probable *Pimina* should be held to have true priority then the French species would become *P. mycophila*.

JAMES WILLIAM HELENUS TRAIL.

(1851—1919.)

By J. Ramsbottom.

James William Helenus Trail, Professor of Botany at Aberdeen, died on Sept. 18th last. He was born at Orkney and was the son of a parish minister who afterwards became Professor of Systematic Theology at Aberdeen. As, in addition, his maternal grandfather was a Professor of Moral Philosophy it is not to be wondered at that his early training was all on the side of the humanities. But, even in his schoolboy days Trail began that systematic collecting which he was to carry on until his death. In spite of lack of encouragement, when he graduated in arts at Aberdeen in 1870 he did so with honours in natural science. He then entered the medical faculty not apparently with any idea of eventually practising, but for the purpose of further scientific training. However, having an opportunity of visiting Brazil as botanist to an expedition organised by the Amazon Steam Navigation Company he left his medical studies for a couple of years.

His work on his botanical and zoological collections brought him into notice and in 1876 he was appointed government botanist to British Guiana. Before he sailed, however, Professor Dickie who was in failing health resigned from the botanical chair and Trail, at the age of twenty-six, was appointed by the Crown to fill the vacancy. From the year 1870 onwards Trail contributed a series of papers and notes on various natural history subjects. He early became interested in systematic mycology being first attracted by parasitic microfungi probably because of his intensive work on phanerogams and on galls. He published valuable revisions of the Scottish species of Peronosporeae, Sphaeropsideae and Melanconieae, Discomycetes, Uredineae and Ustilagineae, and Perisporiaceae, in all of which he made noteworthy additions to the British fungus flora. He contributed to the Scottish Naturalist from its foundation in 1871 and became its Editor from 1883 until 1892 when it was incorporated in the Annals of Scottish Natural History of which he was botanical editor until 1911.

A hint as to his all-round knowledge is given by the fact that when he was a medical student he acted as assistant to the

Professors of Botany, Chemistry and Natural History: and when Professor Nicol retired from the Chair of Natural History in 1878 he held the professorship until a new appointment was made.

The present writer knew of Trail's personality chiefly through meeting his students: it is not usual in these days to encounter such whole-hearted enthusiasm as to a professor's stores of knowledge long after removal from his direct influence. One had only to converse with him on systematic mycology—facts and philosophies—to understand to some extent the admiration in which he was held by those who received their botanical training from him.

One characteristic of Trail was his generosity in the cause of natural science. In 1902 he endowed the Nicol prize in Zoology and the Dickie prizes in Botany at Aberdeen "for the purpose of encouraging students to undertake research in the fauna and flora of Scotland": in 1907 the Helen Scott fund in memory of his mother for the benefit of students in any faculty showing marked ability in botany or zoology who might require assistance to enable them to follow out their studies at the University: in 1909 the Trail fund of the Linnean Society for the presentation of a medal every five years for research during the interval throwing light upon the nature of protoplasm or the physical basis of life.

Trail was elected F.R.S. in 1893 and was president of Section K at the British Association in 1910. He was president of our Society for 1902. I am indebted to an obituary notice by Sir David Prain in Kew Bulletin (1919) for much information. A list of Professor Trail's publications is appended to the notice.

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